

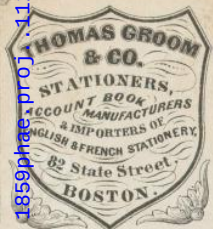
KG
11365
112

C.5

Meridian Marks
Ar. Level & Coll. cor.
From Feb. 24th 1859
To Mar. 11th 1862

Sold by T. Groom & Co., Stationers, India Building, 82 State St., Boston.

1859phaa proj. 112H



KG 11365.112

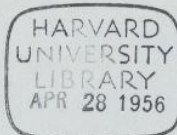
^s
6.948
3.41 3
3.460
6.966

*Equatorial interval
of the wires in the
Transit Circle
H.P.T.
Sept 1859*

New Wires

Dec 5 1860.

KG 11365.112



Intervals of the Wires.

(in the Transit Instrument from 1857. Feb. to 1860. Dec.)

From 60 observations of Polaris and 15 of S. W. Min. I find, assuming the intervals to be constant throughout the whole time,

A to M	= +6.995	lg = 0.84479	(Ill. East)
B to M	= +3.413	0.53814	A is first wire observed.
C to M	= -0.019	8.27875 ⁿ	
D to M	= -3.384	0.52943 ⁿ	
E to M	= -7.005	0.84541 ⁿ	

March 2. 1859.

Ill. East

Ex. Ther 40.0

A. Fla obs.

Level

South	North	Zero	E	W
41.2	52.0	104.0	92.8	x 88.8
41.1	50.8	3.7	93.6	x 88.0
41.0	50.5	4.0	93.2	x 88.3
41.5	51.0	3.2	x 87.4	94.0
41.4	50.6	3.8	x 88.0	93.2
1.2	4.9	18.7	x 88.4	-92.8
41.2	51.0	103.7	543.4	545.1
<u>103.7</u>	<u>103.7</u>		90.58	90.85
62.5	52.7			<u>90.58</u>
				<u>210.27</u>
				0.13

$$S = 1.428$$

$$n = 1.204$$

$$2.632$$

$$0.224$$

$$1.316 - 1.409 = -0.093$$

$$0.112 - 0.732 = -0.620$$

$$a = -0.620$$

$$b = +0.010$$

$$c = -0.093$$

March 8/9 1859

Ill East

Ex. Ther 32.6

A. H

Level

South	North	Zero	E	W
34.6	53.0	105.5	x 83.4	88.5
37.1	51.8	4.4	x 83.3	88.4
36.3	51.4	5.0	x 83.6	87.8
37.1	53.2	4.4	87.4	x 83.2
<u>38.1</u>	<u>51.5</u>	<u>5.2</u>	87.4	x 83.2
33.2	10.9	24.8	<u>87.3</u>	<u>x 82.9</u>
36.64	52.2	104.9	32.4	34.0
<u>104.9</u>	<u>104.9</u>		85.9	85.7
68.3	52.7			<u>85.9</u>
				<u>210.2</u>
				0.10

$$S = 1.561$$

$$n = 1.204$$

$$2.765$$

$$0.357$$

$$1.383 - 1.409 = +0.026$$

$$0.179 - 0.732 = -0.553$$

$$a = -0.553$$

$$b = -0.010$$

$$c = -0.026$$

March ¹⁵/₁₆ 1859

All obs.

Ill. East

Ex. Ther. 39.3-

South	North	Zero
32.0	59.7	104.2
81.0	59.1	5.0
30.3	57.8	5.4
31.9	59.0	5.0
<u>32.0</u>	<u>59.4</u>	<u>5.1</u>
7.2	5.0	124.7
31.45	59.00	104.95
<u>104.95</u>	<u>104.95</u>	
73.50	45.95	

$$S = 1.679$$

$$n = 1.050$$

$$2.729$$

$$0.629$$

$$1.364 - 1.409 = +0.001$$

$$0.314 - 0.732 = -0.418$$

$$a = -0.418$$

$$b = +0.020$$

$$c = +0.045$$

Level	E	W
	84.2	x74.8
	84.7	x74.1
	84.2	x74.2
	x72.9	84.7
	x73.3	84.2
	x73.6	83.4
	472.9	475.4
	78.8	79.2
		<u>78.8</u>
		2) 0.4
		0.20

March 25

A. Th. obs.

Ill. East.

Ex. Ther. 38.2

South.	North.	Zero.
32.1	56.2	105.2
32.8	56.3	4.4
33.0	56.3	4.6
31.7	58.3	4.8
<u>32.9</u>	<u>58.3</u>	<u>5.8</u>
12.5	35.4	24.8
32.50	57.08	104.96
<u>104.96</u>	<u>104.96</u>	
72.46	47.88	

$$S = 1.655$$

$$n = 1.095$$

$$2.750$$

$$0.560$$

$$1.375 - 1.409 = +0.034$$

$$0.280 - 0.732 = -0.452$$

$$a = -0.452$$

$$b = -0.040$$

$$c = +0.034$$

Level.	E.	W.
	x79.0	84.7
	x78.8	84.4
	x79.0	84.3
	85.0	x78.0
	84.8	x77.8
	84.7	x77.7
	491.3	486.9
	81.88	81.13
		<u>81.88</u>
		2) 0.75
		0.37

April 4 1859
Cloudy

Ill East
A.P. obs

Ex th 45°.0

South	North	Zero (telescope pointing north)	Level East West
34.4	57.1	105.7	
34.1	55.2	106.3	82.3 X 75.2
34.9	57.0	106.1	82.3 X 75.0
35.0	55.4	104.5	82.5 X 74.6
34.6	56.0	105.0 X	73.8 82.8
23.0	30.7	26.6 X	73.8 82.5
34.6	56.1	105.3 X	74.0 82.0
105.3	105.3	46.8.7	47.2.1
70.7	49.2	78.12	47.8.88
			78.12
			20.56
			0.28

$$s = 1.665$$

$$n = 1.126$$

$$2.741$$

$$0.489$$

$$1.370 - 1.409 = -0.039$$

$$0.245 - 0.782 = -0.487$$

$$a = -0.487$$

$$b = +0.020$$

$$c = -0.039$$

Apr. 12?

bad observing, A.P. obs.

Ill East

Ex Th 41.8
Level

South	North	Zero	E.	W.
33.0	57.3	105.4	X 76.0	82.5
34.6	56.2	106.1	X 76.1	82.5
35.0	57.2	106.4	X 76.2	82.2
33.7	57.0	105.0	82.1	X 76.0
34.3	56.0	106.7	81.9	X 76.0
20.6	33.7	29.6	81.4	X 76.0
34.14	56.74	105.94	473.7	475.2
105.94	105.94		78.95	79.20
71.80	49.20			78.95
				20.25
				0.125

$$s = 1.640$$

$$n = 1.126$$

$$2.766$$

$$0.514$$

$$1.383 - 1.409 = -0.026$$

$$0.257 - 0.732 = -0.475$$

$$a = -0.475$$

$$b = +0.010$$

$$c = +0.026$$

Apr. 20. 1859

A.H. obs.

Ill. East

Ex. The 54.3°
Level

South

North

Zero
(telescope points south)

E

W

30.0	53.7	103.2	79.0	X 71.6
31.4	52.9	105.0	79.3	X 71.0
28.2	53.3	104.4	79.1	X 70.5
29.5	52.8	104.1	X 69.0	80.0
31.3	53.2	104.6	X 69.2	79.3
28.8	54.0	103.0	X 69.3	79.1
30.0	53.4	104.0	444.9	451.5
209.2	28.1	4.1	74.15	75.25
29.90	53.30	104.00		74.15
104.0	104.0			211.10
74.1	50.7			0.55

$$s = 1.693$$

$$n = 1.158$$

$$2.851$$

$$0.535$$

$$1.425 - 1.409 = +0.016$$

$$0.267 - 0.732 = -0.465$$

$$a = -0.465$$

$$b = +0.044$$

$$c = +0.016$$

Apr. 25 1859

A.H. obs.

Ill. East

Ex. The 59.6°
Level

South

North

Zero
(telescope points north)

E

W

27.2	58.3	104.2	X 67.5	78.0
28.9	55.3	4.1	X 67.3	77.7
29.0	57.4	3.5	X 67.1	77.4
27.2	59.0	4.4	76.3	X 67.0
27.0	57.9	3.3	75.5	X 66.9
39.3	37.9	19.5	75.3	X 66.3
27.86	57.58	103.90	429.0	433.3
103.90	103.90		71.50	72.22
76.04	46.32			71.50

$$s = 1.738$$

$$n = 1.058$$

$$2.796, 1.398 - 1.409 = +0.011$$

$$0.680, 0.340 - 0.732 = -0.392$$

$$a = -0.392$$

$$b = +0.030$$

$$c = +0.011$$

$$0.72$$

$$0.36$$

May 7. 1859.

Ill East

Ex. Ther. $79^{\circ}2$

Marks not visible

Level	
E	W
60.0	X 52.2
58.6	X 50.2
57.0	X 49.6
X 41.7	61.4
X 41.7	60.1
X 40.5	59.2
299.5	332.7
49.92	55.45
	49.92
	2) 5.53
	2.76

$$b = +0.17$$

May 10 All obs

Ill. East

Ex. Ther. $45^{\circ}3$

South	North	Zero	Level	
			E	W
17.8	61.2	104.7	X 61.1	78.4
19.0	61.7	5.1	X 61.2	78.4
18.2	61.2	5.9	X 61.7	77.9
19.0	60.1	5.2	76.6	X 62.6
<u>17.9</u>	<u>61.9</u>	<u>4.1</u>	76.5	X 62.7
42.9	6.1	25.0	76.4	X 62.7
18.58	61.42	105.00	413.5	422.7
<u>105.00</u>	<u>105.00</u>		68.92	70.45
86.42	93.58			68.92
				2) 1.53
				0.76

$$s = 1.975$$

$$n = 0.996$$

$$2.971$$

$$0.979$$

$$1.485 - 1.409 = +0.076$$

$$0.489 - 0.732 = -0.243$$

$$\left. \begin{aligned} a &= -0.243 \\ b &= +0.050 \\ c &= +0.076 \end{aligned} \right\}$$

May ¹⁸/₁₉. 1859

Ill East

Ex Ther 61.8

S.H. obs.		Seivel		
South	North	Dero	E	W
18.8	68.4	103.2	76.6	X 58.5
22.0	63.8	4.1	76.2	X 57.9
20.0	60.2	4.0	76.1	X 57.3
20.0	59.7	4.5	X 53.0	79.3
<u>20.3</u>	<u>61.3</u>	<u>4.9</u>	X 53.4	78.5
20.22	61.48	104.14	X 53.1	78.5
104.14	104.14		388.4	410.0
83.92	42.67		64.73	68.33

$$S = 1.917$$

$$n = 0.976$$

$$2.893 \quad 1.446 - 1.409 = +0.033 \quad a = -0.262$$

$$0.941 \quad 0.470 - 0.732 = -0.262 \quad b = +0.124$$

$$c = +0.037$$

$$2) \frac{3.60}{1.80}$$

Marks very indistinct and unsteady during the above obs.
A.H.

May 19 1859

Ill East

Ex Ther 65.3

S.H. obs.		Seivel		
South	North	Dero	E	W
18.5	67.4	104.7	X 48.4	75.3
17.0	63.4	4.0	X 48.2	74.0
16.0	66.7	4.3	X 47.8	72.6
15.5	66.6	3.1	68.1	X 51.1
<u>16.1</u>	<u>66.3</u>	<u>3.6</u>	66.8	X 51.0
16.62	66.08	103.94	66.8	X 50.2
103.94	103.94		346.1	374.2
87.32	37.86		57.68	62.37

$$S = 1.995$$

$$n = 0.864$$

$$2.859 \quad 1.424 - 1.469 = +0.045$$

$$0.131 \quad 0.565 - 0.732 = -0.167$$

$$a = -0.167$$

$$b = +0.155$$

$$c = +0.015$$

$$57.68$$

$$2) \frac{4.69}{2.34}$$

$$2.34$$

May 27, 1859

Ill East

Ex. Ther. 76.5

		All obs.	Level	
South	North	Zero	E	W
11.8	71.0	103.8	61.3	X 45.0
11.1	72.0	3.3	59.5	X 44.8
10.9	71.8	3.3	58.9	X 44.3
11.7	73.0	4.0	X 89.3	62.3
<u>11.7</u>	<u>70.3</u>	<u>3.3</u>	X 88.4	61.8
11.44	71.62	103.54	X 37.9	61.5
<u>103.54</u>	<u>103.54</u>		295.3	319.7
92.10	31.92		49.22	53.28
				<u>49.22</u>
				2) <u>4.06</u>
				2.03

$$s = 2.104$$

$$n = 0.729$$

$$2.833 \quad 1.416 - 1.409 = +0.053$$

$$1.375 \quad 0.687 - 0.732 = -0.045$$

1.

$$a = -0.045$$

$$b = +0.120$$

$$c = +0.007$$

May 28, 1859

Ill. East

Ex. Ther. 71.5

South North

May 28. 1859

G.P.B. obs.

Ill. East

Ex. Ther. 71.5

South

North

Zero

1.090	0.690	+ 0.90	+ 0.090
1.098	.697	- 0.15	- 0.015
1.100	.697	+ 0.82	+ 0.082
1.098	.693	- 0.17	- 0.017
1.096	0.694		140
0.035	0.035		0.035
.939	0.341		
.035	0.035		

$$s = 2.146$$

$$0.694$$

$$n = 0.778$$

$$2.924 \quad 1.462 - 1.409 = +0.053 = c$$

$$1.368 \quad 0.684 - 0.732 = -0.048 = a$$

May 28. 1859

Reversed The Instrument

Ill. West

Ex Ther. 65.6

G.P.B. obs.

South

North

Zero

Level

May 30

E

W

0.909	0.342	+ 0.092	X 47.7	73.5
0.900	0.325	- 0.017	X 48.0	72.5
0.912	0.320	+ 0.084	X 48.5	71.7
0.914	0.320	- 0.015	65.5	X 53.5
0.909	0.328	0.144	65.0	X 53.5
0.036	0.036	0.036	64.6	X 53.4
0.873	0.292		339.3	378.1
			56.55	63.02

$$s = 1.995$$

$$n = 0.668$$

$$2.663 \quad 1.331 - 1.377 = -0.040$$

$$1.327 \quad 0.663 - 0.732 = -0.069$$

$$\left. \begin{array}{l} a = -0.069 \\ b = +0.220 \\ c = -0.040 \end{array} \right\}$$

$$2) 6.47$$

$$3.23$$

June $\frac{1}{2}$, 1859

Ill. West

Ex. Ther 73.3

A. H. obs.
South North

0.091 0.331

.098 0.343

.081 0.336

.090 0.335

.080 0.340

0.088 0.337

0.912 0.046

.046 0.291

0.866

s = 1.979

n = 0.665

2.644 1.322 - 1.377 = - 0.049

1.314 0.657 - 0.732 = - 0.075

Zero

0.053

.046

.042

.042

.047

0.046

Level

E W

60.0 X 53.0

58.8 X 52.8

58.2 X 51.9

X 47.7 60.2

X 47.0 60.0

X 45.8 60.5

317.5 338.4

52.92 56.40

52.92

213.48

1.74

a = - 0.075

b = + 0.110

c = - 0.049

June $\frac{9}{10}$, 1859

Ill. West

Ex. Ther 74.2

A. H. obs.
South North

0.906 0.360

.890 .362

.894 .350

.900 .358

.909 .354

0.8998 0.3568

0.0268 0.0268

0.8730 0.3302

Zero

0.021

.024

.039

.020

.030

0.0268

E W

X 45.0 70.5

X 43.4 69.0

X 43.2 66.7

58.5 X 49.5

58.0 X 48.9

57.1 X 49.1

305.2 353.7

50.87 58.95

50.87

2180.8

4.04

n = 1.995

s = 0.755

2.550 1.375 - 1.377 = + 0.004

1.240 0.620 - 0.732 = - 0.112

a = - 0.142

b = + 0.260

c = - 0.004

June 15. 1859

Ill. West

Ex. Ther. 75.0

Alt. obs	North	good seeing	Zero	Level	W
South				E	
96.2	24.8		0.040	57.4	X49.8
97.1	26.2		.024	57.1	X49.3
97.0	25.0		.029	56.6	X48.9
97.0	24.0		.036	X40.9	63.5
97.7	24.2		.029	X40.9	63.3
.0	24.2		.158	X40.9	62.4
97.00	24.85		0.032	293.8	337.2
03.20	3.20			48.97	56.20
93.80	21.65				48.97

$$s = 2.143$$

$$n = 0.495$$

$$2.638 \quad 1.319 - 1.377 = -0.058$$

$$1.648 \quad 0.824 - 0.782 = +0.092$$

$$a = +0.092$$

$$b = +0.225$$

$$c = -0.058$$

$$2) 7.23$$

$$3.61$$

June 25. 1859

Ill. West

Ex. Ther. 74.1

good obs.	Alt.				
South	North	Zero	E	Level	W
93.2	30.9	0.027	X46.5		64.5
93.5	30.0	.030	X46.3		63.6
92.9	28.9	.030	X46.3		62.5
92.7	30.2	.033	58.2		X50.0
93.7	30.7	.030	57.1		X50.0
16.0	0.7	0.030	56.7		X49.7
93.20	30.15		311.1		340.3
3.00	3.00		51.85		56.72
90.20	27.15				51.85

$$s = 2.061$$

$$n = 0.620$$

$$2.681 \quad 1.340 - 1.377 = -0.037$$

$$1.441 \quad 0.720 - 0.732 = -0.012$$

$$a = -0.012$$

$$b = +0.150$$

$$c = -0.037$$

$$2) 4.87$$

$$2.43$$

June ²⁹/₃₀, 1859

Ill. West

Ex. Ther. 74.3

South	Alt. obs North	Zero	Level E	W
101.1	20.2	.030	52.8	X 45.5
102.6	22.3	.033	52.9	X 45.3
101.2	22.0	.031	53.0	X 44.7
102.0	20.8	.038	X 34.5	62.7
104.1	20.6	.040	X 35.2	61.5
9.0	5.9	172	X 35.0	61.6
101.80	21.18	.0344	263.4	321.3
3.44	3.44		43.23	53.55
98.36	17.74			43.23
				210.32
				5.16

$$s = 2.247$$

$$n = 0.405$$

$$1.842 \quad 0.921 - .732 = + 0.189$$

$$2.652 \quad 1.326 - 1.417 = - 0.091$$

$$a = + 0.189$$

$$b = + 0.310$$

$$c = - 0.091$$

July 8/9, 1859

Ill. West

Ex. Ther. 73.2

South	Alt. marks invisible North	Zero	Level E	W
			X 40.2	66.4
			X 40.1	66.0
			X 40.0	65.5
			59.8	X 44.9
			58.6	X 45.0
			58.3	X 44.8
			6) 297.0	6) 232.6
			49.50	55.43
				49.50
				2) 5.93
				2.96

$$b = + 0.19$$

.990 too dark
 .962
 1.000
 .975
 .981

July 15, 1859

A. M. obs.

Ill West

Ex. Therm. 75.0

Level

E

W

South

North

Zero

97.6

23.1

1.040

56.4

X 42.5

98.5

24.0

.041

56.5

X 42.4

97.0

24.2

.033

56.3

X 42.2

97.8

24.7

.033

X 34.4

63.8

98.1

24.8

.030

X 35.0

63.2

39.0

.8

177

X 35.4

62.7

97.8

24.2

.035

274.0

316.8

3.5

3.5

45.67

52.80

94.3

20.7

45.67

37.13

3.56

$\delta = 2.155$

$n = 0.473$

2.628

1.314 - 1.377 = -0.057

$a = +0.109$

1.682

0.841 - 732 = +0.109

$b = +0.220$

$c = -0.057$

July 22/23 1859

Ill West

Ex Ther 64.0

South	A.M. good seeing North	Zero	Level E	W
962	273	1.041	X40.6	68.8
980	280	.031	X40.8	69.2
962	282	.044	X41.0	69.5
970	281	.043	63.7	X46.9
969	281	.030	63.8	X46.9
969	279	1.189	63.9	X46.9
.038	1.038	1.038	313.8	348.2
0.931	0.241		52.30	58.03
				52.30
				215.73
				2.86

$$s = 2.127$$

$$n = 0.550$$

$$2.677 \quad 1.338 - 1.371 = -0.033$$

$$1.577 \quad 0.788 - 0.732 = +0.056$$

$$a = +0.056$$

$$b = +0.185$$

$$c = -0.033$$

July 28. Aug 2

Ill. West

Ex Ther 77.5

South	A.M. North	Zero	E.	W.
97.4	23.9	1.026	54.2	X39.8
95.8	24.0	.033	53.2	X40.0
97.0	26.0	.033	53.2	X39.6
98.8	25.2	.025	X31.3	61.2
99.0	24.7	.032	X31.3	61.0
98.0	23.6	.030	X31.5	61.1
97.6	24.7		254.7	312.7
.038	.03.0		42.45	52.12
94.6	21.7			42.45
				219.67
				4.83

$$s = 2.162$$

$$n = 0.496$$

$$s-n \quad 1.666 \quad 0.833 - 0.732 = +0.101$$

$$s+n \quad 2.658 \quad 1.329 - 1.371 = -0.042$$

$$a = +0.101$$

$$b = +0.290$$

$$c = -0.042$$

Aug. 5. 1859

A M very good

Ill. West

Aug. 9.

Ex. Ther. 76.0

South

North

Zero

E

W

99.0

22.1

032

X 33.0

64.5

98.3

21.9

034

X 32.8

64.2

99.7

22.0

030

X 32.8

63.3

99.1

22.5

027

58.0

X 37.2

98.8

21.0

029

57.5

X 37.8

99.0

21.9

030

57.3

X 37.9

03.0

03.0

271.4

304.9

96.0

18.9

45.28

50.82

45.23

215.59

2.79

S = 2.194

n = 0.432

2.626 1.313 - 1.371 = - 0.058

1.762 0.881 - 0.732 = + 0.149

a = + 0.149

b = + 0.165

c = - 0.058

Aug 16 1859
A M

Ex. Ther 67.3

Level

South

North

Zero

E

W

98.0

27.7

104.1

64.8

X 46.9

97.1

28.9

104.0

64.4

X 47.3

97.1

29.4

103.7

64.5

X 47.4

96.8

27.0

103.7

X 39.4

72.6

95.8

26.8

105.0

X 39.6

72.7

94.8

39.8

20.5

X 39.9

72.2

96.96

27.96

104.10

312.6

389.1

104.10

4.10

52.10

59.85

92.86

23.96

52.10

217.75

3.87

S = 2.121

n = 0.547

2.668 1.324 - 1.371 = - 0.037

1.574 0.787 - 0.732 = + 0.055

a = + 0.055

b = + 0.250

c = - 0.037

Aug 16/17. 185-9

Ill. East

Ex. Ther 63.2

A.K.

Level

E	W
X 43.1	80.3
X 43.2	80.2
X 43.1	80.0
71.0	X 51.3
70.3	X 30.6
70.9	X 30.2
341.6	392.6
56.93	65.43
	<u>56.93</u>
	2) 8.50
	4.25

b = +0.280

Aug. 20

A.K.

Ill. East

Ex. Ther 62.4

South	North	Level	E	W
13.0	74.0	1.050	63.2	X 45.2
12.4	72.5	0.43	63.6	X 45.0
13.8	73.4	0.44	63.2	X 45.8
12.2	73.0	0.40	X 33.5	75.5
<u>13.0</u>	<u>75.0</u>	<u>0.40</u>	X 34.5	74.6
14.4	18.2	1.217	X 35.0	74.4
12.9	73.6	1.043	293.0	360.5
<u>104.3</u>	<u>104.3</u>		48.8	60.1
91.4	30.7			<u>48.8</u>
				2) 11.3
				5.65

S = 2.088

n = 0.704

2.792 1.396 - 1.409 = + 0.013

1.384 0.692 - 0.732 = - 0.040

a = -0.040

b = +0.360

c = +0.013

Northman mark very indistinct

A.K.

Aug. 25. 1859

A. 21

Ill. East

Ex Ther 69.0

Level

South	North	Zero	E	W
9.0	73.1	105.2	X 35.8	74.7
9.7	71.8	4.1	X 36.2	73.7
11.0	74.0	4.7	X 36.3	73.0
10.1	73.5	4.7	X 63.8	X 44.9
<u>8.8</u>	<u>72.1</u>	<u>4.1</u>	63.4	X 44.7
48.6	14.5	.8	63.0	X 44.8
9.7	72.9	104.6	298.5	355.8
104.6	104.6		49.8	59.3
94.9	31.7			49.8
S = 2.169				2) 9.5
n = 0.724			a = -0.090	4.8
2.893	1.446	-1.409 = +0.037	b = +0.300	
1.445	0.722	-0.732 = -0.010	c = +0.037	

Aug. 30. 1859

A. 21

Ex Ther

Level

South	North	Zero	E	W
13.2	72.7	104.0	65.0	X 48.0
12.8	72.1	4.8	64.4	X 48.2
12.6	72.4	4.9	64.2	X 48.1
11.9	72.1	4.0	X 34.2	77.2
<u>13.0</u>	<u>72.5</u>	<u>4.6</u>	X 35.8	75.3
12.7	72.4	104.5	X 36.3	74.6
<u>104.5</u>	<u>104.5</u>		299.9	371.4
91.8	32.1		49.98	61.9
				50.0
S = 2.097				2) 11.9
n = 0.733			a = -0.050	5.95
2.830	1.415	-1.409 +0.052	b = +0.380	
1.364	0.682	-0.732 -0.050	c = +0.006 +0.020	

Intervals of Wires of Transit Circle

The collimation = correction for the mean of the wires is to be obtained

by adding $+0.020$ M.E. } to that for the mid-wire.
 -0.020 M.W.

from 10 Polar Observations (May - Aug. 1859).

M.S. Aug. 25th.

By Mr. Hall Sept. 27 1859

From 8 obs of δ Urs Min. 7 obs of γ Cephei.

A = 1st wire U.E. 96.2.

A to M + 6.968	A to E + 6.999	M to A 0.8431	Mean of wires is E of mid-wire
B " " + 3.430	B " E + 3.461	M " 0.5353	96.2.
C " " - 0.031	D " C - 3.354	C " 0.4914	
D " " - 3.385	E " C - 6.952	D " 0.5296	
E " " - 6.983	+10.460	E " 0.8460	
	-10.306		
	5) 154		

Cor. of Coll. of mid-wire 96.2. +0.031 to give coll cor. mean of wires 96.2.

Sept 6.

Ex Ther 64.0

South	North	Dino	Level	W
14.3	71.4	105.5	x38.8	78.5
14.7	72.2	4.0	x39.3	78.0
14.9	70.0	4.3	x39.3	78.1
16.1	72.5	4.6	62.0	x55.3
14.1	70.8	4.9	62.6	x54.5
14.8	71.5	104.7	62.6	x54.4
104.7	104.7		304.6	398.8
89.9	33.2		50.77	66.47
				50.77
				3) 15.70
S = 2.054				7.85
n = 0.719				
2.813 + 4.07 - 1.409 + 0.044			a = -0.084	
1.295 0.648 - 0.732 - 0.084			b = +0.520	
			c = +0.002	

Sept 9, 1859

Ill. East

Ex. Ther. 66.7

South North
Marks invisible

Dens

Small

E

W

58.9

X 54.0

59.6

X 53.1

59.7

X 52.9

X 37.0

75.3

X 37.1

75.2

X 37.4

74.8

289.7

385.3

48.28

64.22

48.28

 $b = +0.51$

215.94

7.97

Sept 12

A 21

Ex. Ther. 70.3

South

North

Dens

Small

E

W

10.7

74.3

103.8

X 34.8

70.7

11.2

72.8

5.0

X 35.9

70.0

10.9

73.4

4.3

X 31.4

70.3

16.6

73.2

3.0

53.4

X 52.0

9.8

72.5

4.1

53.2

X 52.2

13.2

16.2

2

52.6

X 52.8

10.64

73.24

104.04

265.3

368.0

104.04

104.04

44.22

61.33

93.40

30.80

44.22

 $s = 2.134$ $a = -0.017$

217.11

 $b = +0.465$

8.55

 $n = 0.704$ $c = +0.010$ $2.838 \quad 1.419 - 1.469 = +0.010$ $1.430 \quad 0.715 - 0.732 = -0.017$

Sept. 14. 1859

A. H.

Ill. East

Ex Ther. 55.5

South	North	Zero	Level	W
16.5	70.6	104.9	64.2	X 62.2
16.0	72.4	5.0	63.9	X 62.5
17.9	70.6	3.8	64.6	X 62.4
18.4	71.5	3.6	X 48.8	77.0
18.6	72.6	3.2	X 49.1	76.3
37.4	65	20.5	X 49.3	76.0
17.5	71.3	104.1	389.3	416.4
104.1	104.1		56.5	69.4
86.6	32.8			56.5
$s = 1.979$				112.9
$n = 0.749$			$a = -0.117$	6.45
2.728	1.364 - 1.409	$= +0.045$	$b = +0.430$	
1.230	0.615 - 0.732	$= -0.117$	$c = -0.045$	

Sept 19. 1859

A. H.

Ill East

Ex. Ther. 70.1

South	North	Zero	Level	W
16.7	72.0	104.6	58.0	X 58.4
15.9	70.8	3.6	58.1	X 57.7
14.3	71.8	4.0	56.9	X 57.6
16.3	71.5	3.9	X 44.1	69.0
15.0	72.0	104.1	X 43.5	69.1
8.2	8.1	104.04	X 43.3	69.0
15.64	71.62		303.9	380.8
104.04	104.04		50.65	63.63
88.40	32.42			50.61
$s = 2.020$				112.98
$n = 0.740$			$a = -0.092$	6.49
2.760	1.380 - 1.409	$= +0.029$	$b = +0.420$	
1.280	0.640 - 0.732	$= -0.092$	$c = -0.029$	

Oct. 1. 1859

Ill East

Ex. Ther 65.5

South	A 2L North	2d. north Zero	Telescope horizontal and object glass north	Level E	W
16.8	67.1	103.4		X 46.3	73.6
17.8	66.6	3.8		X 46.0	73.0
18.4	67.0	3.8		X 45.4	73.1
18.4	68.6	3.4		60.4	X 57.1
17.6	67.6	3.7		59.9	X 57.4
0				59.5	X 57.4
17.2	67.4	103.6		317.5	391.6
103.6	103.6			52.9	65.3
85.8	36.2				52.9
s = 1.960					2) 12.4
n = 0.828					6.2
2.988	1.394 - 1.409 = + 0.015			a = -0.166	
1.132	0.566 - 0.732 = - 0.166			b = +0.410	
				c = -0.015	

Oct. 3. 1859

Ill. East

Ex Ther 59.7

South	A 2L North	2d. south Zero	Telescope at an angle of 49° obj. glass south and upper	Level E	W
20.9	69.0	104.0		65.0	X 61.1
21.2	69.0	105.2		65.0	X 61.0
20.0	67.5	105.2		64.8	X 60.9
19.4	68.3	106.0		X 48.2	76.8
20.8	67.0	105.8		X 48.5	76.3
20.5	68.2	105.2		X 48.6	76.1
105.2	105.2			340.1	412.2
84.7	37.0			56.7	68.7
					56.2
s = 1.935					2) 12.0
n = 0.845					6.0
2.780	1.390 - 1.409 = - 0.019			a = -0.207	
1.050	0.525 - 0.732 = - 0.207			b = +0.410	
				c = -0.019	

October 3-4 Midnight Levels

East end

West end light West

51.0
53.2
53.2

reversed

70.0
70.2
70.0
367.6
61.26

means

80.0
77.8
77.761.2
61.1
61.0

(original reading 58.9)

417.8
69.63
61.26
2) 8.37
4.18 $b = +0.29$

Oct 3/4 1859

AM

Ill West

Ex Ther. 56.5

South

North

Tel. South
Inco

Telescope same as on Oct. 3.

Level

W

86.9
88.1
88.0
86.8
87.8
37.6
87.5
104.1
83.436.9
37.3
37.4
37.0
36.7
23
37.1
104.4
32.7104.7
5.1
4.2
4.4
3.8
104.4E
68.3
68.1
68.1
X 51.2
X 51.5
X 52.0
559.2
59.9X 62.7
X 62.6
X 62.7
79.1
78.4
78.1
423.6
70.6
59.9
107 $S = 1.906$ $n = 0.747$ $2.653 \quad 1.326 - 1.377 = -0.045$ $1.159 \quad 0.579 - 0.732 = -0.153$ $a = -0.153 \quad b = +0.44$ $b = +0.440$ $a = -0.045$

Oct. 14, 10 8 clock A.M.

J.H. West

A.H.

Ex. Ther 67.2

Level

E	W.
X 47.5	80.5
X 47.5	79.0
X 47.0	78.5
66.5	X 57.9
64.9	X 58.1
63.6	X 58.3
337.0	412.4
56.2	68.7
	56.2

$$b = +0.42$$

412.5

6.25

Oct 18, 5 8 clock P.M.

sunny bad.

A.H.

Ex. Ther

South

North

Zero

81.8	44.0	104.0
83.0	42.5	4.9
83.0	42.0	4.0
82.6	43.1	104.3
104.3	104.3	
78.3	38.8	

$$s = 1.789$$

$$n = 0.886$$

$$2.675 - 1.338 - 1.371 = -0.033$$

$$0.903 - 0.451 - 0.732 = -0.280$$

$$a = -0.281$$

$$b =$$

$$c = -0.033$$

Oct. 24.

A. N.

Ill. West
dy glass south
Zero.Ex Ther. 51.5
Level

South

North

81.4

44.4

14.8

78.3

46.8

3.3

78.1

47.5

4.0

80.6

46.1

5.0

79.547.43.3

397.9

32.2

20.4

79.6

46.4

4.1

4.1

4.1

75.5

42.3

dy glass at angle of 41°
dy glass south and down

E.

W

74.9

X69.1

73.6

X70.0

72.5

X70.6

X59.8

82.8

X60.2

82.2

X60.2

82.0

401.2

456.7

66.9

76.1

66.9

219.2

4.6

$s = 1.725$

$n = 0.967$

2.692

$1.346 - 1.371 = -0.025$

0.758

$0.379 - 0.732 = -0.353$

$a = -0.353$

$b = +0.330$

$c = -0.025$

Nov. 3

Ill. W

Ex Ther 42.0

South

Asi
Northdy glass with
Zero

Level

E

W

77.4

45.9

3.9

X69.2

82.7

76.3

46.9

5.0

X69.8

82.4

76.0

46.0

4.5

X70.0

82.4

76.8

47.0

5.0

176.4

X76.1

76.546.24.8

76.3

X76.9

2.0

76.3X77.1

76.6

46.4

4.6

438.0

478.0

4.6

4.6

73.0

79.7

72.9

41.8

73.0

216.7

3.25

$s = 1.826$

$n = 0.955$

2.781

$1.390 - 1.371 = +0.019$

0.871

$0.433 - 0.732 = -0.297$

$a = -0.297$

$b = +0.250$

$c = +0.019$

Nov. 7, 1859

Ill West

Ex Ther 41.7

A. H.
South NorthTelescope north
Zero

E

Level

W

76.3	47.1	4.0
77.8	49.4	5.0
74.4	50.0	5.3
77.3	48.0	5.9
75.8	48.5	6.0
31.6	.0	
76.3	48.4	5.2
5.2	5.2	
71.1	43.2	

Telescope has sailed
about 9.00 north

82.2	X 68.9
82.4	X 69.5
82.4	X 70.2
X 61.3	89.0
X 61.4	89.0
X 61.7	88.9
43.4	47.53
71.9	79.30
	71.90
	2) 8.45
	8.72

 $s = 1.624$
 $n = 0.988$
 2.612
 0.636
 $1.306 - 1371 = -0.111$
 $0.318 - 0.772 = -0.454$
 $a = -0.414$
 $b = +0.280$
 $c = -0.065$

Nov. 11, 1859 P.M. 4 o'clock

Ill West

Ex Ther 38.3

South

North

Telescope south
Zero

E

Level

W

79.3	44.0	5.3
77.6	46.1	5.7
77.6	44.1	5.8
78.3	45.3	4.3
81.1	43.7	5.8
33.9	23.2	5.3
78.8	44.6	
5.3	5.3	
73.5	39.3	

80.9	X 65.5
80.5	X 67.2
81.0	X 68.0
X 62.8	87.7
X 63.7	87.7
X 64.5	88.0
43.4	46.4.1
72.2	77.4
	72.2
	2) 5.2
	2.6

 $s = 1.679$
 $n = 0.898$
 2.577
 0.781
 $1.288 - 1371 = -0.129$
 $0.390 - 0.772 = -0.382$
 $a = -0.342$
 $b = +0.190$
 $c = -0.083$

Nov. 17, 1859

Ill. West

Ex. Ther. 47.5

A.H.

South

North

Zero

Level

Marks invisible

circle reads 324

E.

W

X 58.1

88.2

X 58.5

87.9

X 58.6

87.8

82.0

X 64.2

81.0

X 65.2

80.3

X 65.9

418.5

459.2

69.75

76.53

69.75

2) 6.78

3.39

 $b = + 0.26$

Nov. 23,

Ill West

Ex. Ther 35.8

* A.H.

with

South

North

Zero

circle reads 218

E

Level

W

85.9

46.8

4.9

87.5

68.5 +

87.6

48.0

4.4

87.4

69.0 +

83.8

47.8

5.0

87.5

69.2 +

84.5

48.3

5.1

+ 66.0

90.9

86.0

48.5

5.1

+ 66.3

90.5

8

4

4.90

+ 67.1

89.8

84.76

47.88

461.8

477.9

4.90

4.90

76.97

79.65

79.86

42.98

76.97

 $s = 1.848$ $n = 0.983$

2.831

 $1.415 - 1.377 = +0.044$ $a = -0.300$ $b = +0.100$

0.865

 $0.432 - 0.732 = -0.300$ $c = +0.044 - 0.011$

2) 2.68

1.34

*.

Marks rather indistinct

Dec 8, 1859.

Ill. West

Ex. Ther. 17.0
Level

South

North

Zero

E

W

each into 325

70.7

46.9

5.8

X 78.3

95.8

66.6

46.0

6.8

X 78.4

96.2

73.6

46.3

7.1

X 78.6

96.2

68.7

47.7

6.8

96.8

X 78.4

72.947.06.5

96.2

X 79.1

352.5

33.9

95.8

X 79.6

70.50

46.78

6.60

524.1

525.3

6.60

6.60

87.35

87.55

63.90

40.18

87.35

87.35

20.20

0.10

S = 1.460

n = 0.919

2.379 1.189 - 1.371 = -0.182

0.541 0.271 - 0.732 = -0.461

a = - 0.461

b = + 0.000

c = - 0.182

Dec 13.

Ex Ther 19.3

South

North

Zero
defective north

E

W

67.1

50.2

5.4

102.2

X 82.1

65.1

50.2

6.2

101.4

X 82.8

68.9

52.0

5.6

100.4

X 83.2

68.7

49.1

6.6

X 81.3

102.2

67.4

50.6

6.1

X 81.8

101.0

37.2

2.1

.9

X 82.0

100.6

67.44

50.42

5.98

549.1

551.9

5.98

5.98

91.52

91.97

61.46

44.44

90.52

10.45

0.22

S = 1.404

n = 1.015

2.419 1.209 - 1.371 = -0.162

0.389 0.199 - 0.732 = -0.538

a = -0.538

b = +0.020

c = -0.162

Dec 21 1859

Ill West

Ex Ther. 33.5

good seeing A 21 telescope north

South	North	Zero
76.4	51.5	5.7
76.1	54.6	5.0
78.1	52.0	5.0
74.3	52.3	6.3
75.9	53.8	5.8
74.96	52.84	5.52
5.52	5.52	
69.44	47.32	

circ. v. 360

Level	E.	W.
X72.7		93.5
X72.8		93.3
X72.9		93.5
94.3		X72.0
93.7		X72.5
93.1		X72.9
499.5		497.7
83.25		82.95
		83.25

s 1.590

a = - 0.479

2) 0.30

n 1.083

b = - 0.010

0.15

2.673 1.336 - 1.371 = - 0.035

c = - 0.035 - 0.041

0.507 0.253 - 0.732 = - 0.479

81

Dec 29, 1859

Ill. West

Ex. Ther. + 6.5

A 21 marks very indistinct

South	North	Zero
72.1	53.2	5.3
69.4	53.3	6.5
68.8	56.0	6.9
68.0	51.0	7.3
68.8	53.6	5.9
37.1	17.1	.9
69.42	53.42	6.38
6.38	6.38	
63.04	47.04	

Level

E	W
X90.4	104.9
X90.8	104.5
X91.2	104.3
108.3	X87.9
107.5	X88.3
106.3	X89.1
594.5	579.4
99.08	96.57
96.57	
2.51	
1.26	

1.441

1.076

2.517 - 1.258 - 1.371 = - 0.113

a = - 0.550

0.365 - 0.182 - 0.732 = - 0.550

b = - 0.110

c = - 0.143

1860

Jan. 5

J.B. West.

Ex Ther. +13.0

South A.H. seeing fair North Zero.

70.7	56.1	6.0
73.0	56.1	6.6
71.8	55.3	7.0
70.2	55.9	6.0
70.1	55.7	6.8
5.8	21	
71.16	55.82	6.48
6.48	6.48	
64.68	49.34	

circle reads 246

Level

E.	W.
104.1	X 86.4
103.5	X 87.4
103.0	X 88.1
X 88.0	103.4
X 88.5	103.3
X 88.9	103.1
576.0	571.7
96.00	95.28
95.28	
0.72	
0.36	

s 1.478

n 1.129

2.607 1.303 - 1.371 = -0.068 - 0.011

0.349 0.174 - 0.732 = -0.558

a = -0.558

b = -0.030

c = -0.068

1860. Jan 12

Ex. Ther 22.0

South A.H. North Zero

75.9	55.9	5.8
75.3	56.9	5.4
77.0	56.5	5.5
77.0	54.3	6.0
77.3	58.0	5.8
76.50	55.72	5.70
5.70	5.70	
70.80	50.02	

circle reads 360

Level

E.	W.
X 77.5	98.6
X 79.0	97.2
X 79.0	97.4
98.8	X 78.5
98.5	X 78.6
97.7	X 79.1
53 0.5	529.4
88.42	88.23
88.23	
2) 0.19	
0.09	

s 1.618

n 1.142

2.760 1.380 - 1.371 = +0.009 - 0.031

0.476 0.238 - 0.732 = -0.494

a = -0.494

b = -0.010

c = +0.009

1860

Jan 17

A.76

Ill West.

Ex Ther 37.8

South

North

Zero

Circle reads 180°

Sun

E

W

75.8

54.0

6.0

96.8

X 74.1

75.4

54.8

5.3

95.5

X 75.3

76.7

53.1

4.7

94.7

X 75.7

75.0

53.5

5.3

X 74.8

95.1

76.0

53.6

5.1

X 71.0

94.2

X 75.3

93.5

75.98

53.80

5.58

512.1

508.3

5.58

5.58

85.35

84.72

70.40

48.22

84.72

2) 0.63

0.31

1.609

1.103

 $a = -0.479$

2.712

1.356 - 1.377 = -0.021

 $b = -0.020$

0.506

0.253 - 0.732 = -0.479

 $c = -0.045$ Jan. 25 0^h Sid. Time

Clear & windy

A.76

Ill. West

Ex. Ther. 40.0

South

North

Sole north

Zero

Sun

E

W

78.9

49.2

4.3

X 69.2

91.5

78.2

49.6

5.9

X 69.6

91.0

78.7

50.1

4.4

X 69.9

90.3

77.4

50.3

5.1

91.4

X 68.7

78.0

49.3

4.9

91.3

X 68.8

91.1

X 68.7

78.24

49.78

4.92

482.5

479.0

4.92

4.92

80.42

79.83

73.32

44.86

79.83

2) 0.59

0.295

3 = 1.675

n. 1.027

 $a = -0.408$

2.702

1.351 - 1.371 = -0.020

 $b = -0.020$

0.648

0.324 - 0.732 = -0.408

 $c = -0.020$

1860

Jan 25 1^h sid time

Ill East

Ex Ther. 27.2

A.H.

Jan 27 level

E

W

South	North	Zero
10.1	54.7	4.4
30.7	54.8	5.4
30.9	53.3	5.7
30.0	53.6	5.0
31.2	54.1	5.4
30.58	54.10	105.18
105.18	105.18	
74.60	51.08	

E	W
96.1	X 76.4
95.7	X 77.2
95.8	X 77.2
X 77.3	95.7
X 77.8	95.3
X 78.3	94.7
521.0	516.5
86.83	86.08
86.08	
2) 0.75	
0.375	

$$S = 1.705$$

$$n = 1.167$$

$$2.872 \quad 1.436 - 1.409 = +0.073 + 0.031$$

$$0.538 \quad 0.269 - 0.732 = -0.463$$

$$a = -0.463$$

$$b = -0.030$$

$$c = +0.027$$

1860 Feb. 1 1^h 20^m Sid 7

Ill. East

Ex Ther. + 3.0

bad observing - marks unsteady

A.H.

level

South	North	Zero
46.13	60.4	104.8
45.3	61.3	4.7
46.6	61.9	4.9
47.0	62.1	4.1
46.9	59.8	5.5
46.38	61.10	104.80
104.80	104.80	
58.42	43.70	

E	W
X 90.4	100.9
X 91.3	101.1
X 91.8	101.4
105.3	X 88.9
105.4	X 89.4
105.1	X 90.3
589.3	572.0
98.22	95.33
95.33	
2) 2.89	
1.44	

$$S = 1.334$$

$$n = 0.999$$

$$2.333 \quad 1.166 - 1.409 = -0.197 + 0.031$$

$$0.335 \quad 0.168 - 0.732 = -0.564$$

$$a = -0.564$$

$$b = -0.130$$

$$c = -0.166$$

are a and c correct? Should not South read 36.1 & c, which would give

$$a = -0.450$$

$$c = -0.050$$

Ill East-
Feb 1, 1860

Level obs

Ill West

Sid. 7. 8^h 5^m Ex Ther - 5.0
E W

Sid. 7. 11^h 10^m Ex Ther - 4.3 ?
E W

108.4	X 90.0	circ. reading
108.6	X 89.4	at both
108.2	X 89.8	Sevellings
X 91.8	106.0	324°
X 91.9	105.4	
X 92.1	105.0	
601.0	585.6	
100.17	97.60	
97.60		
2) 2.57		
1.28	b = - 0.120	

X 96.0	106.0
X 97.2	106.2
X 98.1	105.8
109.5 *	X 96.0
109.8	X 96.8
109.2	X 97.4
619.3	608.2
103.22	101.37
101.37	
2) 1.85	
0.92	b = - 0.080

* The string of the Illumination Regulator got caught in the foot of the Level and spoiled the two first readings after reversal. They were repeated.

1860 Feb. 7

Ill. West

Ex. Ther. 42.0

AZ			Level	
South	North	Zero	E	W
78.0	53.9	3.9	91.1	X 73.2
77.2	54.8	4.4	90.5	X 73.4
79.4	53.4	4.7	89.7	X 73.3
77.2	54.8	4.6	X 73.2	89.4
77.9	55.0	5.1	X 73.0	88.9
77.94	54.34	4.50	X 73.2	88.2
4.50	4.50		490.7	486.4
73.44	49.84		81.78	81.07
			81.07	
			210.71	
			0.35	

$$s = 1.678$$

$$n = 1.140$$

$$2.818 \quad 1.409 - 1.371 = -0.008 = 0.031$$

$$0.538 \quad 0.269 - 0.732 = -0.463$$

$$a = -0.463$$

$$b = -0.020$$

$$c = +0.038$$

1860 Feb. 17

Ill. West

Ex. Ther. 12.5

A.H. marks unsteady			Level	
South	North	Zero	E	W
76.0	48.7	105.0	X 87.9	96.0
75.6	48.8	5.1	X 88.0	96.0
74.8	49.0	6.2	X 88.0	96.0
75.9	47.2	4.3	99.7	X 84.4
74.1	47.4	5.0	98.7	X 85.7
75.28	48.22	115.12	98.7	X 85.2
5.12	5.12		561.0	542.7
70.16	43.10		93.50	90.45
			90.45	
			3.05	
			1.52	

$$s = 1.604$$

$$n = 0.985$$

$$2.589 \quad 1.294 - 1.371 = -0.123 - 0.031 \quad a = -0.423$$

$$0.619 \quad 0.309 - 0.732 = -0.423 \quad b = -0.125$$

$$c = -0.077$$

1860. Feb. 24

Ill. West

Ex Ther. 37.5

A U

South	North	Down
79.5	46.0	5.0
80.0	48.3	6.5
80.7	48.4	5.0
78.9	47.8	5.4
<u>81.3</u>	<u>48.3</u>	<u>5.5</u>
80.08	47.76	5.48
5.48	5.48	
75.60	42.28	

$$s = 1.728$$

$$n = 0.967$$

$$2.695 \quad 1.347 - 1.371 = -0.024 - 0.031$$

$$0.761 \quad 0.380 - 0.732 = -0.352$$

$$a = -0.352$$

$$b = -0.040$$

$$c = -0.024$$

Level

	E	W
180	91.5	X 70.8
	90.8	X 71.6
	90.3	X 71.9
	X 72.0	90.2
185	X 72.6	89.6
	<u>X 73.0</u>	<u>89.4</u>
	490.2	483.5
	81.70	80.58
	<u>80.18</u>	
	211.12	
	0.56	

1860 March 2

Ill. West

Ex Ther 54.6

A U

South	North	Down
83.5	50.8	5.3
82.7	51.8	6.3
83.6	53.0	5.3
82.7	52.1	6.0
82.8	51.9	6.1
<u>83.04</u>	<u>51.92</u>	<u>5.80</u>
5.80	5.80	
77.24	46.12	

$$s = 1.765$$

$$n = 1.054$$

$$2.819 \quad 1.409 - 1.371 = -0.008 - 0.031$$

$$0.711 \quad 0.355 - 0.732 = -0.377$$

$$a = -0.377$$

$$b = -0.045$$

$$c = +0.038$$

Level

	E	W
	X 65.0	86.2
260	X 64.5	86.3
	X 64.4	86.0
	87.2	X 62.6
	86.6	X 62.5
265	86.0	X 63.3
	453.7	446.9
	75.62	74.48
	<u>74.48</u>	

$$211.14$$

$$0.57$$

1860 March 5
H. P. J.

Ill. West

External Ther. = 43.5

Level

South	North	Zero	East	West
79.5	47.1	7.8	93.0	x 70.6
61.0	45.3	6.0	92.5	x 70.6
79.7	44.0	7.9	92.8	x 70.2
79.5	50.0	5.9	x 71.0	91.0
84.1	48.8	6.3	71.7	90.1
40 4.1	23 5.2	32.9	71.5	89.8
<u>.2</u>	<u>.2</u>	<u>.2</u>	6) 492.5	6) 482.5
80.52	47.04	6.78	82.08	80.41
6.78	6.78		80.41	
79.04	40.30		2) 1.67	
			0.83	

$S = 1.692$

$n = 0.921$

$2.613 = \text{sum } 1.306 - 1.371 = -0.111 - 0.041 = -0.142$

$1.771 = \text{diff } 0.385 - 0.722 = -0.347$

$a = -0.347$

$b = -0.066$

$c = -0.065$

March 8
H. P. J.

Ex. Ther. = 46.4

Level

South	North	Zero	East	West
80.8	47.9	4.4	69.5	x 91.3
79.0	49.0	4.5	69.4	x 90.2
79.0	52.5	4.0	68.0	x 88.9
81.3	50.1	4.4	90.5X	63.2
79.5	49.0	4.2	89.0X	62.6
39 9.9	24 8.5	524.5	89.5X	61.4
<u>.2</u>	<u>.2</u>	<u>.5</u>	6) 475.9	6) 457.6
79.98	49.70	4.30	79.31	76.27
6.78	6.78		76.27	
73.20	42.92		3.04	

$S = 1.673$

$n = 0.980$

2.653

0.693

$a = -0.385$

1.326

0.347

$b = -0.110$

1.371

0.732

$c = -0.055$

1.52

$b = -0.110$

1860 Mar. 14

Ill West

Ev Ther 42.0

AZU

South	North	Zero	Level	
			E	W
80.1	51.8	5.3	94.3	X 74.8
78.7	52.1	5.8	93.8	X 74.8
79.5	52.0	6.3	93.9	X 74.2
80.6	52.0	6.0	X 71.3	96.4
79.8	52.5	5.5	X 71.1	96.3
79.70	52.08	5.74	X 71.2	95.8
5.74	5.74		495.6	512.3
73.96	46.34		82.60	85.38

82.60

2.78

1.39

$$s = 1.690$$

$$n = 1.059$$

$$2.749 \quad 1.374 - 1.371 = -0.043 - 0.031 =$$

$$0.631 \quad 0.315 - 0.332 = -0.417$$

$$a = -0.417$$

$$b = +0.110?$$

$$c = +0.003$$

Mar. 15

AZU

Ev Ther 35.0

	Level	
	E	W
	X 71.4	90.0
4	X 72.0	90.2
22	X 72.5	89.8
on	93.0	X 69.7
ways	92.3	X 70.4
	92.0	X 70.5
	71.97	90.0
	92.43	70.2
	164.40	80.07
	82.20	
	80.07	
	22.13	
	1.06	

$$b = -0.085$$

1860 March 16

Illumination West

External Thermometer =
46 $\frac{30}{50}$

76. P. 37

South	North	Zero	Level East	West
82.1	50.7	5.9	92.5	x 64.8
80.6	50.6	5.9	92.6	x 64.8
83.8	49.0	3.8	92.0	x 64.9
81.5	47.5	5.6		
85.2	50.5	4.2	66.0x	90.5
13.2	18.3	3.4	65.4x	90.8
82.64	49.66	5.08	65.3x	89.8
8.08	8.08		473.9	465.6
77.56	44.58		78.98	77.60
			77.60	
			1.38	
s = 1.771				
n = 1.018				
		a = -31.6	0.69	
2.789	1.394 - 1.377 = -0.023 - 0.021	b = -0.55		
0.753	0.376 - 0.732 = -0.356	c = +0.23		

March 16/17 18^h 40^m sid time
A.M.

Ill East

Ex Ther 27.8
swell

Marks invisible

E	W
x 75.7	92.9
x 75.9	93.0
x 76.3	92.6
94.1	x 75.2
93.6	x 75.7
93.6	x 75.8
84.87	84.20
0.67	
0.34	

b = -0.027

1860 March 19 5^h 30^m Sid. J. Ill East

E. Ther 41.0

AZ

swel

South	North	Zero	E	W
26.8	60.7	106.0	88.5	X 66.7
26.7	60.3	5.8	87.8	X 67.5
26.0	60.9	5.7	88.0	X 67.5
25.3	61.1	4.3	X 68.6	87.6
25.9	61.0	5.8	X 69.0	87.5
26.14	60.80	105.52	X 69.2	87.8
10 5.52	105.52			
79.38	44.72		78.51	77.43
S = 1.824			1.08	
n = 1.021			0.54	
2.845	1.422	- 1.409 = +0.059 + 0.107	a = -0.331	b = -0.043
0.803	0.401	- 0.732 = -0.331	c = +0.043	

March 23.

Ill West

E. Ther 38.2

AZ

swel

South	North	Zero	E	W
82.2	50.2	6.1	X 74.8	91.2
83.0	49.8	5.2	X 74.7	91.0
81.7	50.6	5.9	X 74.3	91.2
81.8	50.1	5.7		
82.5	50.2	6.7	93.1	X 71.9
82.24	50.18	5.92	92.0	X 72.8
5.92	5.92		91.9	X 72.7
76.32	44.26			
S = 1.744			74.60	91.13
n = 1.006			92.33	72.47
2.750	1.375	- 1.371 = -0.042 - 0.081	a = -0.363	83.46
0.738	0.369	- 0.732 = -0.363	b = -0.067	81.80
			1.66	
			0.83	

March 27. 1860
A. 26.

Ill West

Ex Ther = 30

Level	
E	W
95.0	X 73.5
94.5	X 74.0
93.8	X 74.0
76.0 X	92.5
76.0	92.7
76.2	92.2
<u>85.25</u>	<u>83.08</u>

2.17

1.08

6 - 0.085

March 27-8

to Illumination East

External Ther = 28

Level

East	West
96.5	+ 74.8
95.6	+ 75.0
95.4	+ 74.8
76.0 X	93.4
76.1 X	93.2
<u>76.2 X</u>	<u>92.5</u>
<u>85.98</u>	<u>83.95</u>

2.03

1.015

3 - 0.080

H. P. J.

1860. Apr. 12
A. H.

Ill East

Ex Ther. 58.

South	North	Zero	Level	
			E	W
23.9	59.6	106.8	X64.8	85.1
25.2	59.1	6.0	X63.8	85.5
26.0	57.0	6.5	X62.4	85.9
26.0	58.0	6.3	87.2	X60.0
26.3	58.3	6.1	83.4	X62.0
25.48	58.40	106.34	83.4	X60.8
106.34	106.34			
80.86	47.94		63.67	81.50
			84.67	60.93
1.870				
1.097			74.17	73.21
2.967	1.483 - 1.409 = +0.120 + 0.031	$a = -0.346$	73.21	
0.773	0.386 - 0.732 = -0.346	$b = -0.040$	2) 0.96	
		$c = +0.074$	0.48	

1860 April 17
H. P. J.

Ill East

Ex Ther = 65

South	North	Zero	Level	
			E	W

1860 Apr. 23

Ill. East

Ex. Ther. 59°

Ill. marks very steady

Level

South	North	Zero	E	W
22.5	62.3	106.0	83.5	X 60.1
21.8	62.7	4.8	83.2	X 59.8
23.1	62.4	4.1	84.0	X 58.5
22.3	62.2	4.4	X 56.1	85.9
22.8	63.4	4.7	X 56.0	85.6
			X 56.3	84.6
22.50	62.60	104.60		
104.60	104.60		69.85	72.42
82.10	42.00			69.81
1.876			$a = -0.264$	2.57
0.960			$b = +0.090$	1.28
2.836	1.418 - 1.409 = +0.055 + 0.031		$c = +0.009$	
0.916	0.458 - 0.720 = -0.264			

1860 May 23
Ill

Ill East

Ex. Ther. 58°
Level

South	*North	Zero	E	W
17.1	66.0	104.3	X 49.4	82.5
18.0	67.4	4.1	X 49.4	82.4
19.7	65.5	4.3	X 49.5	82.1
19.7	64.3	3.3	78.6	52.9
17.8	65.0	4.5	78.3	53.1
42.3	28.2	.5	77.3	53.8
18.46	65.64	104.1		
104.10	104.10		63.75	67.80
85.64	38.46		67.80	
1.980			4.05	
0.878			2.02	
2.858	1.429 - 1.409 = +0.066 + 0.031		$a = -0.169$	
1.102	0.551 - 0.720 = -0.169		$b = +0.140$	
			$c = +0.020$	

* Northern mark quite indistinct

1860 June 2
A. 21

Ill East

Ex. Ther. 65.0

Level

South	North	Zero
16.0	68.4	103.8
15.0	67.1	3.3
18.2	65.0	4.8
16.8	65.0	5.1
17.3	67.5	4.7
83.3	33.0	21.7
16.65 ± 0.37	66.50 ± 0.46	104.34 ± 0.23
104.34	104.34	
87.69	37.84	

E	W
74.8	X 51.1
74.3	X 51.2
74.0	X 51.1
X 42.0	81.8
X 42.5	81.3
X 42.8	80.6
350.4	397.5

s = 2.004

n = 0.864

2.868 1.434 - 1.409 = + 0.071 + 0.031

1.140 0.570 - 0.720 = - 0.150

a = - 0.150

b = + 0.264

c = + 0.025

66.25

58.40

17.85

3.92

June 11

Ill East

Ex. Ther. 67.0

Level

South	North	Zero
12.4	67.7	105.0
11.8	70.0	4.3
13.2	68.5	3.7
12.3	69.0	
12.5	69.7	
	344.9	104.33
12.44	68.98	
104.33	104.33	
91.89	35.35	

E	W
X 41.6	81.0
X 41.8	80.0
X 43.0	78.0
71.8	X 47.0
70.4	X 47.8
69.9	X 47.9
338.5	381.7

s = 2.100

n = 0.808

2.908 1.454 - 1.409 = + 0.091 + 0.051

1.292 0.646 - 0.720 = - 0.074

a = - 0.074

b = + 0.240

c = + 0.045

63.62

7.20

3.60

June 21 H. P. Y Illumination East
External Ther. = 54

South	North	Zero	Level	
15.0	66.9	104.6	W 48.5	E 74.6 x
12.0	70.0	5.2	49.5	74.3 x
10.3	70.9	4.0	49.9	74.1 x
9.0	69.5	4.7	80.9 x	43.6
11.6	69.1	6.0	76.8 x	47.0
5) 57.9	5) 348.4	5) 24.5	76.0 x	47.9
11.58	69.68	104.8	6) 381.6	6) 361.5
104.90	104.90		63.60	60.25
93.32	35.22			
2.132			63.60	
0.805		$a = -0.047$	60.25	
2.937	$1.468 - 1.409 = +0.105$	$b = +0.11$	33.35	
1.327	$0.663 - 0.720 = -0.057$	$c = +0.039$	1.67	

The atmosphere was very unsteady at the time of observing the marks

June 30
H.P.T.

Illumination East

		Level		
South	North	Zero	West	East
10.4	73.4	16.0	72.5	x33.6
7.3	76.0	15.0	69.7	x35.4
6.0	75.9	7.0	68.8	35.6
6.3	74.5	16.5	41.6x	62.8
<u>10.0</u>	<u>75.3</u>	<u>16.4</u>	41.2x	61.3
41.0	375.1	30.9	41.5x	60.5
<u>8.20</u>	<u>75.02</u>	6.18	335.3	289.2
106.18	106.18		55.88	~~57.18~~ 48.20
<u>97.98</u>	<u>31.16</u>			~~57.6~~
				$\frac{1}{2} \cdot 2 = 1$
2.239			a + 0.043	55.88
<u>0.712</u>			2 + 0.24	48.20
2.951	1.475 - 1.409 = +0.112 + 0.021		c = +0.066	2) 7.68
1.527	0.763 - 0.720 = +0.043			3.84

July 11 1860
H.P. J.

Ex Ther. = 68.8

			Level		
* South	North	Zero	East	West	
16.7	74.0	5.0	67.1	X 42.5	
11.0	73.0	6.4	66.5	X 44.2	
16.2	76.3	4.2	66.0	X 44.5	
12.4	77.5	4.8	36.0 X	74.5	
<u>11.2</u>	<u>74.4</u>	<u>4.8</u>	37.0 X	73.0	
67.5	375.2	25.2	37.1 X	73.0	
13.5	75.04	5.04	309.7	352.0	
105.04	105.04	100	51.61	58.66	
<u>91.54</u>	<u>30.00</u>	<u>105.04</u>	58.66		
			7.05		
			3.52		

2.091

0.686

2.777

1.405

$$1.388 - 1.409 = +0.025 + 0.037$$

$$0.702 - 0.720 = -0.018$$

$$a = -0.018$$

$$b = +0.22$$

$$c = +0.024$$

* Marks mostly

July 29 Ex. Ther 64.5

Level July 30

South	North	Zero	Level	East	West
18.1	71.7	3.9		41.0	+73.2
17.8	71.1	6.1		40.6	+72.5
17.7	72.0	5.0		40.7	+71.6
17.5	70.5	5.5		63.0x	48.6
17.0	72.0	5.1		64.0x	47.0
5) 88.1	5) 357.3	5) 25.6		63.3x	47.0
17.6	71.4	5.12	6) 312.6	6) 359.9	
105.12	105.12	100	52.1	59.9	
87.52	39.72	105.12		52.1	
					7.8
					3.9

2.007

0.761

2.768

1.246

$$1.384 - 1.409 = +0.021 + 0.031$$

$$0.761 - 0.720 = +0.041$$

$$a = +0.041$$

$$b = +0.260$$

$$c = -0.025$$

July 29

July 30

$$a + 0.041$$

$$b$$

$$c + 0.052$$

$$a = +0.041$$

$$b = +0.250$$

$$c = +0.052$$

$$b + 0.25$$

Aug. 15, 1860

A.L.

Ill East

Ex Ther 67°

South	North	Zero
11.8	73.3	105.4
11.5	74.7	5.1
10.2	73.2	5.2
11.1	74.1	5.0
<u>11.3</u>	<u>74.7</u>	<u>5.4</u>
11.18	74.00	105.22
105.22	105.22	
94.04	31.22	

s 2.157
n 0.713

a =

$$2.870 \quad 1.431 - 1.409 = +0.072 + 0.021$$

$$1.444 \quad 0.722 - 0.720 = +0.002$$

Level	W
~~64.0~~	~~X 47.0~~
64.0	X 46.8
63.2	X 47.5
~~X 73.2~~	~~X 56.2~~
~~X 73.5~~	~~56.5~~
~~X 73.8~~	~~56.1~~

~~65.68~~

51.68

51.68 Aug. 16, level again 51.74

169.5

2

W.

18.47

X 35.5
X 34.6
X 34.0

72.7
73.3
73.4

a = +0.002

62.4

X 43.3

b = +0.320

61.8

X 44.5

c = +0.026

61.3

X 44.4

48.43

58.60

58.60

10.17

5.08

There are some trees which
partly hide the Southern mark

Aug. 27.

Arc

Ill. East

Ex Ther
Level

South	North	Zero
7.2	74.2	105.5
8.8	73.3	6.0
7.5	74.5	4.9
10.0	74.2	6.0
<u>7.3</u>	<u>74.0</u>	<u>5.1</u>
8.2	74.0	
<u>105.5</u>	<u>105.5</u>	
97.3	31.5	

s = 2.223

n = 0.719

s + n = 2.942

s - n = 1.504

1.471

0.752

1.4090.732

c + 0.708

a + 0.020

a = +0.020

b = +0.41

c = +0.062

Level	W.
58.4	X 43.0
58.0	X 42.8
58.1	X 42.4
~~X 28.5~~	~~71.0~~
X 28.8	70.5
X 28.8	70.2
260.6	339.9
43.43	
<u>56.65</u>	

13.22

6.61

b = +0.41

Sept. 24. 1860

Ill East

Ex Ther 67.0

South	North	good seeing	Sum	Σ	Swell
17.0	66.8	105.4		+ 36.8	76.5
16.8	67.4	4.7		+ 36.8	76.5
19.1	67.6	4.2		+ 36.5	76.4
17.6	66.7	4.2		65.0	+ 47.5
<u>17.8</u>	<u>66.8</u>	<u>4.3</u>		65.0	+ 47.5
38.3				<u>64.8</u>	+ 47.5
17.66	67.10	104.58			
104.58	104.58			50.81	
86.92	37.48			<u>61.58</u>	
				2) 11.17	5.58

1.986

0.852

2.842

1.130

$$1.421 - 1.409 = +0.012 + 0.037$$

$$0.565 - 0.720 = -0.155$$

$$a = -0.155$$

$$b = +0.428$$

$$c = +0.082$$

Oct 26.

Ill East

Ex Ther 63.5

South	North	fair seeing	Sum	Σ	Swell
19.7	61.8	108.8		74.5	X 53.7
21.7	61.0	5.0		73.8	X 54.0
21.1	60.2	4.5		73.4	X 53.6
19.0	61.0	4.7		X 42.5	82.2
<u>22.0</u>	<u>59.6</u>	<u>4.0</u>		X 42.2	82.1
.5		.0		X <u>42.5</u>	<u>81.5</u>
20.70	60.72				
104.80	104.80			58.15	
84.10	44.08			67.85	
S = 1.921				9.70	
n = 1.007				4.85	

2.928

0.914

$$1.464 - 1.409 = +0.101 + 0.031$$

$$0.457 - 0.720 = -0.263$$

$$a = -0.263$$

$$b = +0.330$$

$$c = +0.055$$

Oct. 28, 1860.

Ill. East

Ex. Ther. 62.5

Level	
Σ	W
+ 46.0	88.4
45.8	88.1
45.4	87.6
78.1	+ 54.1
76.9	+ 54.5
<u>75.5</u>	<u>54.4</u>
45.7	88.2
<u>76.8</u>	<u>54.3</u>
122.5	142.5
	71.25
$b = + 0.352$	<u>61.25</u>
	10.00
	5.00

Nov. 6, 1860

Ill. East

Ex. Ther 49.0

A. H.

Level

South	North	Zero	Σ	W
25.0	63.4	104.1	78.6	+ 58.8
24.5	64.1	3.7	78.5	58.8
26.0	63.8	4.1	78.4	58.8
26.8	62.8	4.1	+ 49.5	87.5
<u>26.5</u>	<u>63.5</u>	<u>4.0</u>	49.7	87.4
25.8	63.5		<u>50.0</u>	<u>86.7</u>
104.0	104.0		64.1	
78.2	40.5		73.0	
			<u>218.9</u>	
			4.45	

$$s = 1.787$$

$$n = 0.925$$

$$s + n = 2.712$$

$$s - n = 0.862$$

$$\frac{s+n}{2} = 1.356 - 1.409 = -0.007 + 0.031 = +0.024$$

$$\frac{s-n}{2} = 0.431 - 0.732 = -0.301 = -0.301$$

$$a = -0.301$$

$$b = +0.312$$

$$c = +0.053$$

Note. There has been a heavy rain today.

Nov. 16

Ill Ear

Ex Ther 44°

A.U.

Level

South

North

Zero

Circle reads 180 (Painter)

E

W

33.1

56.7

105.6

+ 55.6

89.8

30.2

56.5

4.5

+ 55.8

89.6

32.6

57.7

5.5

+ 55.9

89.6

32.5

56.1

5.4

81.3

+ 63.8

33.1

57.0

5.1

81.6

+ 63.4

11.5

81.6

+ 63.7

32.30

56.60

10 5.22

105.22

55.77

89.73

72.92

48.62

81.50

63.70

137.27

152.43

68.63

s 1.666

76.21

7.58

n 1.112

144.84

379

s+n 2.778

$$\frac{s+n}{2} = 1.389 - 1.409 = +0.026 + 0.031 = +0.057$$

s-n 0.554

$$\frac{s-n}{2} = 0.277 - 0.732 = -0.455$$

72.42

b = 0.278

$$a = -0.455$$

$$b = +0.278$$

$$c = +0.020$$

Nov 22

Ill Ear

Ex Ther 36.0

A.U.

Marks very indistinct and unsteady

Level

South

North

Zero

E

W

31.0 { 41.0 }

57.0

105.8

85.8

+ 71.1

30.0 { 40.0 }

55.2

105.0

85.8

71.2

33.0 { 43.0 }

57.2

104.2

84.4

71.5

30.3 { 40.3 }

55.0

+ 63.7

93.8

32.1 { 42.1 }

56.1

64.0

93.5

.9

63.8

93.8

31.36 { 41.36 }

56.58

10 5.00

10 5.00

82.48

73.64 { 63.64 }

48.42

1.683

2.790

1.395

$$- 1.409 = +0.032 + 0.031$$

74.58

1.107

0.576

0.288

$$- 0.732 = -0.444$$

7.90

1.455

3.95

1.107

2.562

1.281

- 1.409

= -0.128

+ 0.031

0.348

0.174

- 0.732

= -0.558

$$\left\{ \begin{array}{l} a = -0.558 \\ b = +0.302 \\ c = -0.128 \end{array} \right\}$$

$$\left\{ \begin{array}{l} a = -0.444 \\ b = +0.302 \\ c = -0.064 \end{array} \right\}$$

Probably a mistake of 10 div. in reading the micrometer for South A.U.

Nov. 28. 1860

Ill. East

Ex. ther 36.5°
Level

North	South	Zero.	Σ	W
59.2	32.4	105.5	67.6	92.1
59.7	30.3	5.0	68.2	91.5
59.8	31.4	5.1	68.3	91.5
60.4	31.6	4.4	87.4	+ 72.5
58.7	31.3	5.5	87.4	72.6
			86.8	73.1
59.56	31.40			
105.10	105.10		68.04	91.70
45.54	73.70		87.20	72.73
				77.62
$S = 1.684$				82.22
$n = 10.40$			$a = -0.410$	4.60
2.724	$1.362 - 1.409 - 0.007 + 0.034$		$b = +0.174$	2.30
0.644	$0.322 - 0.732 - 0.410$		$c = +0.037$	

Sec 1.	North	South	Zero	Σ	W
				88.8	+ 72.8
				88.0	73.3
				87.5	74.1
				+ 66.8	94.3
				66.8	94.2
				66.5	94.3
				88.10	73.40
				66.70	24.37
				754.8	167.67
				77.40	
				83.83	
				06.43	$b = +0.248$
				3.21	
1.689					
0.969				$a = -0.372$	
2.658	$1.329 - 1.409 = -0.080$			$b = +0.248$	
0.720	$0.360 - 0.732 = -0.372$			$c = -0.080$	

The preceding observation of the marks on Dec 1. is the last one made with the system of wires which has been used until then in this book. The wires were broken out Dec 2. Mr Bond has put in a new set to-day.

Dec 4th 1860.

From four observations of Polaris Oct. 27, Nov. 1, Nov 19 and Nov 23, 1860, I find the following intervals, giving double weight to the observations of Nov. 1 and Nov. 19, there being three observations on each wire,

A to C + 7.018	7.000
B " " + 3.431	+3.413
	-0.018
D " " - 3.367	3.345
E " " - 6.991	~~7.970~~
	7.069
+ 10.449	
- 10.358	
5) + 0.091	
A to C + 0.018	

A.H.

New Wires

Dec 5 1860.

Dec 6, A.M. *

Σ x $\frac{1}{2}$ 28.8

South	North	Zero	Level Σ	W
60.5	88.0	34.0	+ 76.0	97.0
61.0	89.3	34.0	75.8	97.0
63.6	88.0	34.0	76.0	96.8
59.0	89.5		93.5	+ 79.0
58.7	89.3		92.5	79.6
22.8			93.1	78.7
60.6	88.8		84.48	
34.0	34.0		88.01	
73.4	45.2		3.53	
			1.76	

$s = 1.677$ $\text{sum} = 2.710$ $1.355 - 1.363 = -0.008$ collimation of mid wire by mark
 $n = 1.033$ $\text{diff.} = 0.644$ $0.322 - 0.732 = -0.410$ $a = -0.410$
 $b = +0.137$
 $c = -0.008$

* The Southern mark seen with difficulty

A.H.

Dec. 17. 1860.

M. East

Ex. Ther
Level

A.M.

South	North	Zero	East	West
61.7	81.0	32.8	+ 97.2	+ 82.1
62.0	80.2	33.6	96.8	82.0
62.5	82.2	33.9	96.0	82.7
61.4	81.4	34.0	+ 78.2	99.8
<u>62.8</u>	<u>81.7</u>	<u>33.0</u>	78.0	99.7
62.1	81.3		78.0	99.3
33.5	33.5			
71.4	52.2			

1.631

1.193

2.824 1.412 - 1.363 = + 0.049

0.438 0.219 - 0.732 = - 0.513

$$a = -0.513$$

$$b = +0.142$$

$$c = +0.049 \text{ coll. mid wire}$$

96.67
 78.07
 174.74

82.27
 99.60
 181.87

87.37
 90.93
 178.30
 1.78

Dec 24

A.M.

Ex. Ther 21°
Level

South	North	Zero	E	W
68.0	87.6	34.2	+ 81.3	98.8
70.0	87.0	34.2	81.8	98.5
69.2	85.3	34.1	82.0	98.4
68.8	86.8		98.8	+ 82.0
<u>68.1</u>	<u>87.5</u>		98.1	82.8
4.5	34.2		<u>97.6</u>	<u>83.1</u>
68.90	86.84			
34.17	34.17			
65.27	47.33			

81.7
 98.2
 179.9
 89.95
 90.10
 2) 0.25
 0.37

98.8
 82.8
 181.4

s = 1.493 2.576 1.288 - 1.363

n = 1.083 0.440 0.205 - 0.732

$$a = -0.527$$

$$b = +0.030$$

$$\text{collimation of mid} = -0.075 \text{ by marks}$$

Jan. 1/2. 1860.

Ex. Ther. 33.0

J. H. S.

South	North
63.2	81.4
61.5	83.5
63.4	82.8
64.4	82.3
63.3	84.4
63.16	82.88
(33.43)	(33.43)
70.27	50.55

1.606

1.155

2.761

0.451

$$1.380 - 1.363 = +0.017 + 0.025 = 0.042$$

$$0.226 - 0.732 = -0.506$$

a - 0.506

b

c + 0.042

Jan 8. 1861

Ex Ther. 27.0

Level

South	North	Zero
64.1	88.5	33.5
65.6	88.5	33.4
64.5	88.3	33.0
65.5	87.6	
64.2	88.0	
64.66	88.18	
33.30	33.30	
88.69	45.12	

1.569

1.030

2.599

0.539

$$1.299 - 1.363 = -0.064$$

$$0.269 - 0.732 = -0.463$$

Σ	W.P.
+ 78.7	+ 97.2
79.0	97.1
78.6	97.3
95.3	+ 80.6
94.9	80.5
95.0	80.5
86.92	
89.86	
212.94	1.47

b = +0.117

Jan 21. 1861.

North	South	Zero
85.5	66.0	32.7
83.4	64.3	33.0
85.8	65.6	32.5
84.90	65.3	
32.7	32.7	
47.8	67.4	

Ex Ther. 21.8

Σ	Level
98.2	+ 82.8
98.2	+ 82.4
98.0	+ 82.4
+ 82.2	97.9
+ 82.0	98.0
+ 82.0	98.0

$$n = 1.093$$

$$S = 1.540$$

$$2.633$$

$$0.447$$

$$1.317 - 1.363 = -0.046 (+0.083)$$

$$0.223 - 0.732 = -0.509$$

$$98.13$$

$$82.07$$

$$90.10$$

$$b = +0.007$$

$$82.53$$

$$97.97$$

$$90.25$$

$$90.10$$

$$21.13$$

$$0.75$$

Jan 25. 1861.

North	South	Zero
82.8	66.4	30.0
86.0	66.4	30.2
83.3	67.3	
83.9	68.5	36.6
84.4	67.5	36.0
83.68	67.22	
33.56	33.56	
50.12	66.34	33.20
		33.92
		33.56

Ext. Inv. 29°

31.92 On one side of
32.0 wire

36.3 on the other
35.5 side
focus changed

$$n = 1.115$$

$$S = 1.566$$

$$2.667$$

$$1.330 - 1.363 = -0.033$$

$$0.185 - 0.732 = -0.547$$

Intervals of Wires. put in Dec 5, 1860.

From three obs. of δ^1 Cephei and two of Polaris I find

$$\begin{array}{rcl}
 AC = + 6.743 & \text{Hence } AM = + 6.693 & \text{by } 0.456 \\
 BC = + 3.451 & BM = + 3.401 & 0.5316 \\
 DC = - 3.361 & CM = - 0.050 & 8.6990 \\
 EC = - 6.581 & DM = - 3.411 & 0.5329 \\
 & EM = - 6.631 & 0.8216 \\
 & + 10.194 & \\
 & - 9.942 & \\
 5) + 0.252 & & \\
 + 0.050 & &
 \end{array}$$

A.M. Jan. 26, 1861.

Jan 26, 1861 J.H.S.

North.	South.	Zero
84.6	62.3	32.4
86.0	62.8	30.8
86.0	63.4	
83.6	62.3	35.2
84.6	63.1	34.8
<u>84.56</u>	<u>62.78</u>	<u>32.80</u>
32.80	32.80	
48.24	70.02	

Jan. 30, 1861. 1^h 30^m W. J.H.S.

No.	So.	Zero
81.4	68.3	34.7
81.0	68.6	30.0
84.0	71.0	29.9
83.4	67.4	36.6
84.2	68.0	37.0
<u>83.40</u>	<u>68.66</u>	<u>35.6</u>
33.13	33.13	33.13
49.73	64.47	

$$\begin{array}{rcl}
 n & 1.104 & \\
 s & 1.600 & \\
 2.704 & 1.352 - 1.363 = -0.011 - 0.07 & \\
 & 0.264 - 0.732 = -0.468 &
 \end{array}$$

$$\begin{array}{rcl}
 n & 1.136 & \\
 s & 1.474 & \\
 2.610 & 1.305 - 1.363 = -0.058 & \\
 & 0.169 - 0.732 = -0.563 &
 \end{array}$$

Jan 31. 1861 J.H.S

<u>South</u>	<u>North</u>	<u>Zero.</u>
--------------	--------------	--------------

66.4	81.1	35.2
67.0	80.3	35.4
65.9	81.4	—
65.8	80.4	31.5
65.4	81.3	31.6
66.18	80.90	33.42

1.

67.24 52.52

$$11 \quad 1.537 \quad 1.368 - 1.363 = + 0.005$$

$$5 \quad 1.200 \quad 0.168 - 0.732 = - 0.564$$

Feb. 13. 1861

Ill. East

Ex Ther
Level

South	A.H. North	Zero	Σ	W
57.4	86.2	32.0	92.1	+ 68.2
59.1	86.0	32.0	91.5	68.8
59.0	87.0	32.0	90.8	69.2
58.0	86.3		+ 69.3	90.5
59.2	86.4		69.4	90.2
42.7			69.6	90.0
58.54	86.38			
32.00	32.00		80.45	79.48
73.46	43.62		Diff 0.97	
			0.485	b = -0.040

$$s = 1.678$$

$$n = 1.042$$

$$2.720 \quad 1.360 - 1.363 = -0.003$$

$$0.636 \quad 0.318 - 0.732 = -0.414$$

Feb. 18.

Ill. East

Ex Ther 37.0
W

South	A.H. North	Zero	Σ	Level
60.0	89.0	34.5	+ 72.2	92.2
60.5	89.0	34.2	72.8	91.5
61.0	89.0	33.0	72.9	91.0
60.0	88.8	33.8	92.6	+ 71.5
60.9	88.6	33.6	92.2	72.0
			92.0	72.2
60.48	88.88	33.82		
33.82	33.82		82.45	81.71
73.34	44.94		0.74	
			0.37	b = +0.030

$$n = 1.676$$

$$s = 1.027$$

$$2.703 \quad 1.351 - 1.363 = -0.012 - .06 = c$$

$$0.649 \quad 0.324 - 0.732 = -0.408 = a$$

N.B. The micrometer wire not being vertical the Zero will differ at different points on the midwire,

March 16. 1861

Ill East

Ex Ther 39°

AU

Level

South

North

Zero

circle reads 180°

E

W

59.6

82.8

32.5

96.0

+ 76.0

60.0

81.4

32.1

95.8

75.6

60.8

80.3

32.8

95.3

75.6

59.8

82.5

+ 76.5

93.4

59.8

81.4

76.0

93.8

60.00

81.68

76.2

92.9

82.47

32.47

85.96

72.47

50.79

84.51

1.41

1.655

 $b = -0.056, 0.705$

1.160

 $2.815 \quad 1.407 - 1.363 = +0.044 - 0.050 \quad c = -0.006$ $0.495 \quad 0.247 - 0.732 = -0.485$

$$a = -0.485 \quad m = a \sin \phi + b \cos \phi = [9.827] a + [9.868] b$$

$$b = -0.056 \quad m = a \cos \phi + b \sin \phi = +[9.868] a + [9.827] b$$

lg. a 9.685 n

lg. b 8.748 n

9.514 n

9.553

8.616 n

8.577 n

lg. m 7.565 n

lg. n 7.505

m -0.368

-20.0

20.7

19.7

+ 16.9

17.8

16.7

17.10

Apr. 17. 1861

A.M.

Ill East

Ex Ther 39.5°

South	North	Zero	Level	
			E	W
53.1	93.4	33.0	88.2	65.0
53.0	93.3	31.6	88.8	64.6
53.3	91.3	31.4	88.5	64.9
52.8	93.8	32.3	66.2	87.0
<u>54.0</u>	<u>92.8</u>	<u>31.5</u>	66.4	87.2
53.24	92.92	31.96	<u>67.1</u>	<u>86.6</u>
31.96	31.96		77.53	75.88
78.72	39.04			1.65
				0.82 b = -0.07

$$s = 1.798$$

$$n = 0.900$$

$$2.698 \quad 1.349 - 1.363 = -0.014$$

$$0.898 \quad 0.449 - 0.732 = -0.283$$

Lucy, ought not North to be 82.92?

May 7.

A.M.

Ill East

Ex Ther. 66°

South	North	Zero	Level	
			E	W
49.9	84.1	32.2	+46.2	85.1
49.2	84.3	31.2	47.0	82.6
49.3	83.8	31.9	47.8	82.2
51.0	83.9		78.2	+51.3
<u>51.2</u>	<u>84.9</u>		77.2	52.2
50.1	84.0		<u>76.7</u>	<u>52.2</u>
31.7	31.7		62.2	67.6
81.6	47.7			5.4
				2.7 b = -0.19

$$s = 1.865$$

$$n = 1.091$$

$$2.956 \quad 1.478 - 1.363 = +0.115 = \text{Coll of mid wire}$$

$$0.774 \quad 0.387 - 0.732 = -0.345$$

June 7. 1861

A.M.

South	North	Zero
41.0	92.5	33.2
42.1	93.8	32.7
41.4	93.0	32.6
40.0	92.8	32.83
41.6	92.0	
41.22	92.82	
32.83	32.83	
91.61	40.01	

EC, then 61°

Level	
E	W
80.0	+ 51.1
79.6	51.0
+ 50.6	79.5
50.7	79.2
65.22	65.20
0.02	
0.01	
6+ 0.00	

S 2.093

N 0.914

3.007 1.503 - 1.363 = + 0.140

1.179 0.589 - 0.732 = - 0.143

The southern mark is nearly hid by trees.

July 19.

South	North	Zero
-------	-------	------

Level	
E	W

Sept 12, 1861

Ex Ther 68.5

All		Level	
South	North	E	W
40.0	96.0	+ 39.8	77.5
40.9	94.7	40.5	75.8
<u>41.8</u>	<u>92.0</u>	60.7	+ 55.5
40.9	94.2	<u>60.3</u>	<u>55.4</u>
31.8	31.8	50.25	61.05
90.9	37.6		10.8
		$s = 2.077 \quad 2.936$ $n = 0.859 \quad 1.218$ $1.468 - 1.363 = +0.105 \quad c$ $0.609 - 0.732 = -0.123 \quad a$ $+ 0.350 \quad b$	

Oct 12, 1861

Ex Ther 61.8

		Level	
South	North	E	W
45.0	95.0	+ 42.0	78.0
45.9	95.1	41.3	78.8
<u>44.7</u>	<u>96.0</u>	70.5	+ 49.4
45.2	95.4	<u>70.2</u>	<u>49.8</u>
31.2	31.2	56.0	64.0
86.0	35.8		8.0
			4.0

Septth 1861. M. East. J.H.S.

Collimating eye-piece

Reflected wire movable between	C and D	Detected by
	D and C	a
Direct wire	" "	a'
	C and D	b
Observed on West side	" "	1
East side		2

b.1	29.6	a' 1.	9.6
a.1	84.5	b' 1.	61.0
b.2	30.8	b' 2	64.5
a.2	91.5	a' 2	~~7.3~~

b.1	45.3
a.1	47.05
b.2	47.65
a.2	49.4
Mean	47.35
Zero	
L-m	

A is the first wire and E the last, Illumination East. The micrometer reading is however the least for E . (variable)

If the direct and reflected wire be placed successively in the same position with respect to the fixed wire seen direct, the mean of the micrometer readings for both positions will be the micrometer reading of the line of collimation, when the axis is level.

⁹⁰⁰ (continued to second)

Let x denote each mean: four values of x in general being taken, as on preceding page, in order to eliminate personal equation. Then will $(\frac{1}{2}x - m + \delta)$ be the collimation of the wire which is at the micrometer reading 3 , when the illumination is East; and $m - \frac{1}{2}x + \delta$ when Illumination is West.

Dec 18/19 1861. Ext. Lr. 30.4 M. E.

Level. (Circle Reading 145)
W.

89.8 77.3 +
89.7 77.2 +
70.4 + 95.3
69.7 + 95.2
79.9 86.25

Mean

Zero

a. 1.	81.2	a'1	7.3	44.25	34.0	} Side a of wire
B 1	23.7	B'1.	63.6	43.65	34.0	
B 2	28.2	B'2	66.5	47.35	30.6	} " b " "
a 2	83.6	a'2	9.0	46.30	29.5	
				45.39	32.02	
				32.02		

x-m -13.37

A-m -0.305 in time

B +0.250

Collim. of mid-wire -0.055

Cor. for mean of rr. +0.050

-0.005

Daily Aberr.

b = 6.35
0.250

Dec. 19.0 1861. Alt. 42.5 Alt. East.

Level.

E.

N.

67.4 +	89.8
66.8 +	90.6
85.1	71.2 +
85.2	71.2 +
<u>76.12</u>	<u>80.85</u>

a 2 75.0	a'2 6.9	40.95	33.8
b 2 15.5	b'2 64.9	40.20	32.0
b 1 18.7	b'1 63.0	40.85	30.4
m 1 78.6	a'1 77	<u>43.15</u>	<u>30.6</u>
		41.29	31.70
		<u>31.70</u>	

z-m -9.59
1/2 wt -10.02

-9.73

z-m -0.222

b +0.178

Cy mid wire -0.044

+0.050

c. +0.006

Ref. mid wire between
direct pins & micr

74.6

72.0

68.8

71.8

31.7

4) 40.1

z-m -10.02

Taken (as well as preceding) at a wrong Circ = reading.
The setting = micrometer had changed quite suddenly.

Dec. 20. 1861.

All East.
good lying

Ex. Ther. 43.0

Marks	North	Den	E	Level, Pointer 324 (about)
Soud				W
55.0	87.7	30.2	84.2	70.4 +
56.0	87.4	29.8	84.8	69.9
55.8	86.7	30.6	+ 63.6	90.5-
53.6	86.8	30.20	64.5-	89.7
54.4	85.4		74.27	80.12
54.96	86.82		diff. 5.85-	
30.20	30.20		+ 0.220	
75.24	43.38			

$s = 1.720$

2.712

$1.356 - 1.363 = -0.007 = \text{cor. of mid wire}$

$a = -0.368$

$n = 0.992$

0.728

$0.364 - 0.732 = -0.368 = a$

$b = +0.220$

$(c = -0.057)$

The Constants 1.363 and 0.732 or A , and C , contain the correction for Daily Aberration and a reduction (mid-wire - mean) = +0.027. They need a small correction therefore for the present system of wires.

Dec 21, 1861

Dec 24, 1861.

Ill. East.

Ex. Ther. 22.5°

Marks			Level. Pointer 324 (above)	
South	North	Zero	E	N
70.4	85.9	31.5	(Marks quite unsteady) + 76.5	95.8
68.8	86.0	31.1	77.0	95.4
70.2	87.3	<u>31.0</u>	93.1	79.4 +
70.3	83.4		<u>93.0</u>	<u>79.2</u>
<u>66.4</u>	<u>84.2</u>		84.90	87.45
69.22	85.36			
31.02	31.02		Diff. 2.55	
61.80	45.66		$\delta = +0.105$	

1.412 2.435 1.227 - 1.363 = - 0.136
 1.043 0.369 0.184 - 0.732 = - 0.548

Ext. Ther. 16.08

E. N.

a 1	65.5	a' 1	6.5	36.0
b 1	4.71	b' 1	60.4	32.6
a 2	64.0	a' 2	3.8	33.9
b 2	5.5	b' 2	60.4	<u>33.0</u>

135.5
 33.9
 Zero. 33.0
 z-m - 0.9
 - 0.021
 + 0.144

Coll. g. mid. + 0.123

92.0	83.6 +
93.5	83.2 +
79.6 +	97.8
<u>81.4 +</u>	<u>96.2</u>
346.5	360.8
86.62	90.20
$\delta = +0.144$	

1861 Dec. 21. AM. M. East.

a1	64.8	a'1	8.0	36.8
	66.2			
b1	9.0	b'1	61.3	34.2
	5.0			

Zero
High Power
27.5 } One Side
28.6 }

a2	59.3	a'2	7.5	33.4
b2	6.5	b'2	63.7	35.1
			4) 139.5	
			m. 34.88	

34.6 } In Other
34.0 }

E W East W. 29.4.

+ 80.2	101.2
+ 80.0	100.6
95.8	+ 52.8
95.1	+ 52.6
351.1	367.2
87.9	91.8

G. + 0.163

a1	67.0	a'1	6.8	36.9
b1	11.6	b'1	~~11.5~~	38.2
a2	too much disturbance			
b2				37.95

General Mean m 35.77
Σ 31.25
Σ - m -4.52
- 0.103
G + 0.163

Coll. of mid wire + 0.060

1861 Dec 27 Am. St. East.

Zero (in column)

a1	64.0	a'1	5.6	34.8
b1	10.62	b'1	62.5	37.2
	13.0			

a2	63.4	a'2	8.0	35.7
b2	5.8	b'2	59.6	32.7
				4) 140.4
				35.10

~~Star~~ E.

W.

Exp. Time 40.6

85.5	+ 81.6
84.4	+ 82.4
+ 74.4	91.0
+ 75.5	89.2
319.8	344.2
79.95	86.05

1.57

6.10
24.2
11

b + 0.238

Zero

a1	63.3	a'1	7.2	35.2	37.3
b1	12.0	b'1	68.4	36.7	36.0
a2	62.4	a'2	3.3	32.8	32.5
b2	3.5	b'2	68.4	34.4	32.0
				4) 141.1	34.4

35.28

Mean 35.19

+ 34.4

2-m - 0.79

Spa - 0.018

+ 0.238

Ref. and with + 0.220

11111

Dec 27. 1861 at 2 o'clock p.m.

Ex Ther 35.5°

Marks

South	North	Zero.
61.1	84.3	31.1
62.0	83.0	31.7
62.7	84.5	31.0
61.93	83.97	
<u>31.27</u>	<u>31.27</u>	
69.34	47.30	

$$s = 1.585 \quad 2.667 \quad 1.333 - 1.363 - 0.030$$

$$n = 1.082 \quad 0.503 \quad 0.251 - 0.732 - 0.481$$

1861 Jan 14, 1st Sid. Time JWS

a z	63.9	a' z	11.2
b z	10.8	b' z	67.1

E W

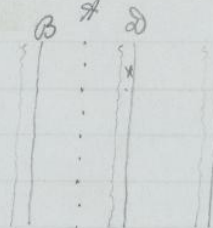
+ 89.3	97.6
+ 87.9	98.8
+ 87.7	98.3
97.0 ⁺	+ 88.2 <i>repeat</i>
94.6	+ 90.6
94.6	+ 92.2
6) 11.1	2 25.7
91.83	94.28
	2.43
	1.215
	2 +0.100

* I am somewhat doubtful where the level was placed on the pivots in this levelling

1862. Jan. 31

Ill. West

Nadir.



$$AD = a$$

$$z = \text{zero}$$

$$r_0 = \text{reading for refl.}$$

$$r_1 = \text{" " dir.}$$

$$-a + x = r_0 - z$$

$$a = r_1 - z$$

$$\frac{z}{2} = \frac{r_0 + r_1}{2} - z = c + b$$

South	Mark	North	Zero
4.8	91.4	31.5	
3.2	91.0	32.0	
3.0	91.9	32.1	

E	West	Pointer 324°
91.4	+ 83.8	
91.3	+ 83.7	
+ 85.8	89.7	
+ <u>85.5</u>	<u>90.0</u>	
88.5	86.80	
2) 1.70		
0.85	b = -0.068	

1862. Feb 1.

Ill West

61 10.7 51 62.1
 21 21.8 81 69.8

T.H. observer

~~a1 77.0~~ ~~a'1 12.5~~ Circle not quite right
~~61 21.6~~ ~~81 69.8~~

11.8
 62 ~~4.0~~ 6'2 64.6 38.2 |
 a2 65.0 a'2 6.5 35.8 |

Ill West

A.H. observer

Exther 25.5

West
 a.1 12.0 6.1 65.0
 a1 69.9 6.1 10.0

Zero?
 32.2

Ref. wire in East of dir.

East
 a.2 10.2 6.2 75.8
 a.2 70.0 6.2 9.1

The zero was not observed
 and this value has been
 assumed. Will begin right
 on next page.
 A.H.

Level
 E W
 + 89.0 90.8
 88.3 90.6
 97.3 + 81.8
97.2 81.4
 92.95 86.15
 6.80
 $b = -0.282$

40.95

37.50

40.10

42.45

m 40.25

2 32.20

m-2 8.05 = +0.184

 $b = -0.282$

Col. mid. wire -0.098

Feb. 3. 1862

Ill. West

Ex Mer. 26.4

M.

Zero

61	7.0	a1	61.0	304
61	73.0	a'1	17.2	29.0
12.2		76.0		28.2
75.0		13.5		27.2

Zero with
high Pow.

31.2

30.9

31.0

6.1	8.5	a.1	61.0	40.1
6.1	71.8	a'1	18.8	39.9

15.2	64.8	40.0
74.6	20.0	42.0

on 40.5

4 31.0

m-2 9.5 = +0.217

8 -0.101

C of mid wire +0.116

Marks

South	North
8.3	99.4
6.5	99.1
5.3	99.7
106.7	99.4
31.0	31.0
75.7	68.4
1.730	

6563

3.293 1.641 - 1.363 + 0.278

0.167 0.083 - 0.732 - 0.649

Level, Pointer 324°
(at 0^h 15^m sid Time)

E	W
+ 85.7	94.2
86.3	93.3
86.5	93.0
95.6	+ 83.7
96.0	82.9
94.4	84.0
90.75	88.51
+ 2.24	1.14
b = -0.092	

Level
(at 2^h 0^m sid Time)
Pointer 324°

E	W
+ 86.5	92.3
86.6	92.2
95.2	+ 83.5
94.7	83.9
363.0	351.9
90.75	
87.98	
2.77	1.38
b = -0.110	

Feb. 4. 1862

All

Ill West

Ex. Ther. 25.4

W
 6.1 5.8 a.1 62.2
 6.1 69.0 a.1 10.0

Σ

10.6 60.0 32.1
 60.8 10.0 31.9
 32.0

37.4

36.1

38.2

35.0

m 36.67

Σ 32.00

m-2 4.67 + 0.106

b - 0.032

Col. m.w. + 0.074

Level Pointer 324°
 (Sid Time 1^h 25^m)

Σ W
 96.1 + 84.6
 95.5 85.0
 + 85.2 95.1
 85.2 94.6
 95.4 + 84.2
 94.2 84.7
 + 84.8 93.9
 85.3 93.1
 721.7 715.2
 90.21 89.40

0.81 0.40

b = - 0.032

Feb. 5. 1862

All

Ill West

Ex. Ther. 23.5 - In. Ther. 29°

(Sid) 2^h 15^m
 Level Pointer 324°

W W
 13.9 62.6 32.1
 72.7 18.3 31.8
 East. 31.5
 11.0 64.0
 70.8 16.0

Σ W
 + 85.6 92.1
 85.6 92.2
 95.1 + 82.7
 94.7 82.0
 341.0 347.0
 90.25 86.71

3.60 1.71

(Sid Time 8^h 10^m) Ex. Ther. 14°

Pointer 324° Σ W In. Ther. 17°
 100.8 + 89.8
 100.8 90.4
 + 95.9 97.0
 96.0 97.1
 98.38 93.62

Taken after sunrise.

1.76 2.38

b = - 0.200

43.3

40.4

40.9

40.0

m 40.15

Σ 31.8

m-2 9.31 = + 0.214

b = - 0.140

Col. m.w. + 0.074

Feb 6, 1862

All Work

Ex. Ther 32.6
In " 30.0

AZU

W

Zero

Level Pointer 324°
Sid Time (2^h 10^m)

7.0	64.0	31.0
62.2	8.5	31.5

E

32.0

E	W
+ 85.7	91.2

7.3	61.0	31.5
65.0	10.8	

85.5

91.2

94.8

+ 81.4

94.2

81.9

90.05

85.92

4.13

2.06

6-

34.6

36.2

36.2

35.9

m 35.7

Σ 31.5

m-2 4.2 = +0.096

6 = -0.164

Col. m.w - 0.068

Feb. 7. Found the Sun shining on East Pier this Noon

Feb. 7

AZU

W

Zero

Ex. Ther 34.2

In. " 34.1

Level Pointer 324°
Sid Time (2^h 0^m)

9.7	60.3	31.0
77.0	21.0	30.5

E

31.2

E	W
91.6	80.4

7.2	60.8
76.8	18.0

91.3

+ 80.7

+ 80.7

90.0

80.6

90.1

86.05

85.30

0.75 0.375

Sid Time (8^h 0^m) Ex. Ther 23.8

m 41.3

Σ 30.9

m-2 10.4 = +0.238

6 = -0.030

Col. m.w = +0.208

+ 86.2

92.5

In. " 27.0

86.0

92.8

95.7

83.5

96.1

82.6

364.0

351.4

91.00

87.85

1.57 6-0.125

Feb. 8, 1862

Ill. West

AM

West

Zero

10.0	60.5	31.0
76.5	19.7	31.5
		31.8

E

11.0	63.5
72.0	17.0

43.2

41.5

40.1

40.2

m 41.2

2 31.4

m-2 + 9.8 = +0.224

b = -0.112

Col. m.w. + 0.112

Ex. Ther 25.4

In .. 29.0

Lid Time (2 25)

Level Pointer 324°

E W

95.3 + 81.5

95.1 82.0

94.7 82.5

+ 84.4 92.6

85.0 92.5

85.6 92.3

540.1 523.4

90.02 87.23

87.23

2.79 1.395

Feb. 10.

Ill. West

AM

West

9.4	60.5	31.5
76.8	21.0	32.1
		32.4

East

10.0	60.8
74.5	16.2

43.1

42.2

40.7

38.5

41.1

32.0

9.1 = +0.208

Col. m.w. = -0.160

+ 0.048

Level

Lid Time

E

W

+ 83.8 91.6

83.9 91.6

95.8 + 79.8

95.4 80.2

358.9 343.2

89.72

85.80

3.92 1.96

Ex. Ther 22.0

In .. 30.0

Pointer 324°

1862. Feb. 11

M. West

Ex. Ther 29.4

Sun was shining on East Pier this Noon.

In " 29.0

AZ

Level

Pointing 324°

West

Zero

E

W

8.6 61.0

30.5

96.3 + 81.5

82.0 28.0

30.5

95.6 81.8

31.0

+ 83.4 93.6

East

83.6 94.0

8.4 64.7

35-8.9 35-0.9

76.0 21.0

89.72

87.72

2.00 1.00

45.3

44.5

41.2

42.8

m 43.4

2 31.7

11.7 = + 0.267

b = - 0.080

Col. mw = + 0.187

1862. Feb. 12

M. West

Ex. Ther 34.0

In " 32.0

Pointing 324°

AZ

Level

West

Zero

E

W

11.1 64.4

30.3

+ 82.5 90.5

72.5 22.0

30.2

82.5 90.4

29.8

93.8 + 78.6

East

94.1 + 78.1

9.5 62.4

352.9 337.5

70.0 16.0

88.22

82.09

6.03 3.01

41.7

43.2

39.7

39.2

m 41.0

2 30.1

9.9 = + 0.227

b = - 0.240

Col. mw = - 0.013

13 Feb. 1862

All

Ill West

Ex. Ther +33°
In " +33
Pointer 324

West

Zero

Level

5.8	62.2
72.8	19.8

30.8
30.7
31.3

E	W
95.2	+79.8
94.4	80.2
+81.4	92.5
<u>80.0</u>	<u>92.6</u>
351.0	345.1
87.75	
<u>86.27</u>	
1.48	0.74

East

8.5	63.0
71.2	15.0

39.8
41.0
39.8
<u>39.0</u>
m 39.9
2 30.9

$$m - 2 + 9.0 = +0.206$$

$$6 = -0.060$$

$$\text{Col. mm} = +0.146$$

1862. Feb. 14.

All

Ill West

Ex. Ther 33.5°
In " 33.0
Pointer 324°

West

Zero

Level

9.3	62.5
71.5	17.0

30.6
31.0
31.2

E	W
+80.8	91.3
80.5	91.4
94.6	77.1
<u>94.5</u>	<u>76.8</u>
350.4	336.6
87.60	
84.15	
3.45	1.72

East

7.8	60.0
74.0	18.7

40.4
39.7
40.9
<u>39.3</u>
m 40.0
2 30.9

$$9.1 + 0.208$$

$$6 - 0.140$$

$$\text{Col. mm} + 0.068$$

Feb. 15, 1862

Ill. West

Exther 21°

All (wires reflected rather unsatisfactory)

In .. 27°

West

Zero

Pointer 324°

7.5

66.9

31.0

Level

78.2

24.0

31.2

E

W

98.0

+ 83.5

97.7

83.8

+ 86.9

94.5

87.2

94.0

369.8

355.8

East

12.8

66.0

74.8

22.0

42.75

45.45

43.80

44.00

m 44.0

2 31.1

m-2+12.9 = + 0.295

b = - 0.140

col. mW = + 0.155

92.45

88.95

3.50 1.75

b = - 0.140

Feb. 15.

Revised the Instrument

Ill East

Immediately after preceding observations

Exther 19.7

Inther 27

Pointer 324

West

Zero

14.4

68.0

33.8

69.0

15.0

34.0

33.6

East

12.0

64.5

72.0

21.6

Level

+ 84.0

96.9

84.5

96.3

91.0

+ 89.9

90.0

90.4

349.5

373.5

87.37

93.37

6.00

3.00

b = + 0.250

The preceding obs. were taken soon after sunrise. The Zero was observed by illuminating the axis

Feb. 17. 1862

AM

All East

Ex. Ther 25.7

In Ther 29

Pointer 324°

West

6.2	63.6	30.0
69.8	15.4	31.2
		30.5

East

8.8	64.0
74.0	17.5

38.0

39.5

41.4

40.7

m 39.9

z 30.6

m-2 9.3 - 0.213

b = + 0.204

Cdmw - 0.009

Feb. 18

AM

All East

Ex. Ther 35.0

In " 34.0

Pointer 324°

W

6.8	61.0	30.9
70.6	16.2	30.0
		31.0

E

8.2	63.8
75.2	20.0

38.7

38.6

41.7

41.9

160.9

m 40.2

z 30.6

9.6 - 0.220

b = + 0.082

Cdmw - 0.138

Level

E	W
+ 80.8	94.0
80.8	93.8
92.1	+ 82.8
91.7	82.9
345.4	353.5
86.35	
86.37	
2.02	1.01
b + 0.102	

Feb. 19, 1862.

An

M. East

Ex. Ther 33.0
In. 33.0
Pointer 324°

West

Zero

6.1	64.0
69.7	14.2

East

4.8	61.3
75.0	20.3

37.9

39.1

39.9

40.8

m 39.4

$$2 \frac{30.6}{8.8} - 0.201$$

Feb. 20, 1862.

An

M. East

Ex. Ther 31.5
In. 32.0
Pointer 324°

West

Zero

5.2	61.1	30.0
71.0	15.5	31.4

30.0

East

30.9

7.0	62.8	30.5
74.1	18.5	

38.1

38.3

40.5

40.7

m 39.4

2 30.6

$$m-2 \quad 8.8 - 0.201$$

Level

E

W

+ 79.0	92.6
79.0	92.4

91.3	+ 80.1
------	--------

90.4	80.6
------	------

90.1	80.7
------	------

89.6	80.9
------	------

+ 77.4	93.0
--------	------

78.0	92.3
------	------

674.8	692.6
-------	-------

84.45

86.58

2.13 1.06

$$b = +0.085$$

Feb. 21, 1862

All

Ill East

 Exther 28.7
 In " 30.0
 Pointer 324
 Level

West		Zero
11.2	62.5	31.2
64.4	9.2	30.0
		30.6

East	
7.6	64.6
69.0	16.0

37.8
 35.7
 38.3
40.3

m 38.0

2 30.6

$$7.4 = -0.169$$

E	W
+ 80.0	92.4
79.7	93.0
91.6	80.8
91.4	+ 81.2
91.7	80.6
91.2	81.0
90.9	81.3
+ 79.0	92.5
<u>79.4</u>	<u>92.3</u>
774.9	775.1
86.10	
<u>86.12</u>	

0.02 0.01

$$b = +0.000$$

Feb. 24

All

Ill East

 Exther 36.5
 In " 36.0
 Pointer 324
 Level

West		Zero
5.0	64.2	
68.0	14.0	

East	
6.9	63.8
68.0	18.0

36.5

36.1

37.4

40.9

37.7

30.6

$$m-2 \quad 7.1 = -0.$$

E	W
+ 77.2	91.2
77.0	91.5
90.3	+ 77.5
<u>89.0</u>	<u>78.6</u>
333.5	338.8
83.37	
<u>84.70</u>	
1.33	0.67
$b = +$	0.053

1862. Feb. 25

MH

M. East

Ex Ther 19.0
In Ther 24.0
Pointer 324°

West

Zero

30.9

30.2

30.0

30.4

East

E

Level

W

96.5

+ 88.0

97.0

88.0

+ 86.0

98.5

86.0

98.4

86.0

98.2

86.3

98.0

96.5

+ 87.5

96.2

87.9

730.5

744.5

91.31

93.06

MH

1.75

0.87

b = +0.070

1862. Feb. 26.

MH

M. East

Ex Ther
In Ther
Pointer 324°

West

5.4

59.4

61.0

10.3

East

8.0

61.0

68.6

18.0

Zero

27.9

28.8

28.4

28.6

28.0

Level

E

W

91.2

+ 81.5

91.2

81.7

+ 79.3

93.4

79.7

93.0

79.6

92.9

79.8

92.6

91.3

+ 80.1

90.5

81.2

682.6

696.9

85.74

87.12

m 36.5

1.78 0.89

z 28.2

b = +0.071

m-z 8.4 = - 0.192

1862, Feb. 27.

A.H.

All East

Exther 24.0
 In Ther 29.0
 Pointer 324.0
 Level

West		Zero
7.8	58.6	26.0
64.2	17.4	26.8
		26.4

East	
6.8	59.1
67.5	19.0

36.0

38.0

37.1

39.0

37.5

26.4

-m+2 11.1 = -0.

E	W
92.8	+84.5
93.4	84.0
+82.6	95.2
82.2	95.4
82.8	94.7
82.9	94.5
92.9	84.3
92.7	84.4

Feb. 28

All East

Exther 22.0
 In Ther 27.
 Pointer 324.0
 Level

West		Zero
7.0	58.0	26.0
57.0	6.7	26.8
		27.0

East	
6.0	59.8
63.0	8.0

E	W
94.4	+87.5
95.2	87.0
+83.5	98.8
83.4	98.6

1862. Mar. 1.

AM

Ill East

Exther 32.0
In " 31.0
Pointer 324°
Level

West
8.0 61.0 27.0
73.0 18.0 27.2
27.3

Marks
N S
87.0 65.8
86.5 67.0 + 80.3
86.7 65.9 80.7
86.9 66.3 93.0
87.0 66.6 93.0
86.8 66.3 347.0
86.75
27.2 27.2 87.37
40.4 60.9 0.62

East
9.2 62.0
75.0 180

40.5

42.1

39.5

40.0

m 40.5

2 27.2

13.3 = - 0.304

Reversed to Ill West after above obs.

(cleaned the Pivots and Ys)

Mar 1

Ill West

Exther 30.0
In " 30.0
Pointer 324
Level

West
27.8
27.0
27.7

East

Marks
N S
88.2 2.3
87.5 1.3
88.0 1.0
88.3 2.0 + 80.5
88.4 1.0 80.8
88.1 101.5 348.6
27.5 27.5 87.15
60.6 74.0 86.40
0.75 0.37

b = - 0.030

I found the Pivots quite dirty and on the Ys, each side of the bearings, a thick crust of gummy dirt. This dirt we rubbed off with oil and then wiped dry with a clean cloth. I should think the dirt on the Pivots must have affected the levelling.

AZL

4⁰ It had been the practice to oil & wipe the pivots
at the time of reversal. It is possible that too much oil
may have sometimes been left on them.

1862. Mar. 3

Ill. West

Ex. Ther 33.5

In " 32.0

Pointer 324°

A.K.

West		Zero.		Level	
1.3	57.2	26.1	E	W	
62.3	8.0	26.0	+ 78.0	94.0	
		26.3	77.8	94.1	
East			94.9	+ 76.6	
10.7	59.0		94.3	76.7	
53.0	8.2		93.8	76.9	
			93.6	76.8	
31.8			+ 76.3	93.6	
32.6			76.0	93.8	
31.8			684.7	682.5	
33.6			85.59 - 0.28		
m 32.4			85.31 - 0.14	b = - 0.011	
z 26.1					
6.3	= + 0.144				
	b = - 0.011				
col mid W	+ 0.133				

Mar. 4

Ill. West

Ex. Ther 32.0

In Ther 34.0

Pointer 324°

A.K.

West		Zero		Level	
5.8	59.9	25.5	E	W	
60.0	7.5	27.2	+ 77.9	91.3	
		27.2	77.2	92.3	
East			92.3	+ 77.2	
7.5	60.0		91.8	77.4	
56.8	3.5		91.8	77.3	
			91.6	77.2	
32.9			+ 76.5	92.3	
33.7			76.3	92.3	
32.1			675.4	677.3	
31.7			84.42 + 0.24		
m 32.6			84.66 + 0.12	b = + 0.010	
z 26.6					
6.0	+ 0.137 col. m v v + 0.147				
	b = + 0.010				

1862. Mar 5

A.M.

Ill. West

 Ex. ther 34.7
 In. ther 38.0
 Pointer 324

West

Zero

Level

 9.5- 62.0
 55.8 + 4.0

 27.0
 26.5
 26.0

 E W
 + 73.2 89.5

East

 8.9 62.0
 54.0 1.0

 72.7 90.3
 90.7 + 72.2

90.4 72.3

89.8 72.8

89.6 72.6

+ 71.0 91.2

71.0 91.1

648.4 652.0

16) 3.6

+ 0.22 b = + 0.017

32.6

33.0

31.4

31.5

m 32.1

2 26.5

m-2 + 5.6 = + 0.128

b = + 0.017

Col. mw + 0.145

1862. Mar. 6

A.M.

Ill. West

 Ex. ther 32.6
 In. " 34.5
 Pointer 324°

West

Zero

Level

 7.5- 62.0
 55.0 2.0

 27.0
 27.3
 26.3

 E W
 + 77.0 92.6

76.4 93.5

93.7 + 76.2

93.5 76.4

93.1 76.4

93.0 76.3

+ 75.4 93.8

75.4 93.6

677.5 678.8

East

 10.0 63.0
 54.0 2.0

31.2

32.0

32.0

32.5

m 32.0

2 26.9

5.1 = + 0.116

b = + 0.007

Col mw = + 0.123

14) 1.3

0.08

b = + 0.007

1862. Mar. 7

A.H.

Ill. West

Out. Ther 38°.0

In. " 37.0

Pointer 324°

West

Zero

Level

4.0 58.0
59.7 5.2

26.0

25.8

26.3

E

W

+ 73.6

91.3

73.3

91.6

91.2

+ 73.5

90.9

73.7

90.6

73.8

90.6

73.6

+ 72.0

92.0

72.1

92.0

654.3

661.5

16) 7.2

0.45 b = + 0.036

East

5.6 56.9
54.2 0.0

31.8

31.6

29.9

28.4

m 30.4

Σ 26.0

m-2 + 4.4 = + 0.100

b = + 0.036

Col. mw + 0.136

Mar. 8

A.H.

Ill. West

Out. Ther 41°.0

In. Ther 40.0

Pointer 324°

West

Zero

Marks

5.8 62.0
57.6 3.0

27.0

26.3

25.4

N

S

83.5

8.1

E

W⁰

85.2

7.8

+ 73.2

92.1

85.5

6.3

72.7

92.5

85.1

6.0

92.3

+ 72.5

84.9

6.0

91.3

72.7

84.8

106.8

90.9

72.6

26.2

26.2

90.4

72.5

58.6

80.6

+ 70.7

91.8

70.7

91.5

652.2

658.2

m 31.2

81.52

Σ 26.2

82.27

m-2 + 5.0 = + 0.114

0.75

b = + 0.030

0.37

Col. mw = + 0.144

Reversed after above obs.

1862. Mar. 8

Ill. East

Out Ther 38.0
In " 38.0
Pointer 324
Level

Southern mark has become invisible

Marks

All

	N	Z	West	
81.0	25.0	6.0	58.0	
82.5	25.6	62.0	11.0	
82.7	25.8		East	
80.5		7.0	59.0	
82.5		67.0	18.0	
81.8			34.0	
25.5			34.5	
43.7			37.0	
58.6			38.5	
14.9		m	36.0	
7.41		Z	25.5	

$$\text{Col. m.w.} = 0.177$$

$$2 - m - 10.5 = -0.240$$

$$b = +0.107$$

$$\text{Col. m.w.} = -0.133$$

E	W
+70.9	92.1
70.7	92.0
89.3	+73.2
89.2	73.1
89.0	73.0
88.8	73.1
+69.6	91.9
70.0	91.3
637.5	659.7
	82.46
	79.61
	2.85
	1.42

Mar. 10

Ill. East

Out. Ther.
In "
Pointer 324
Level

West	All	Zero.
6.2	59.0	26.0
65.0	11.8	

East

5.8	59.5
66.2	20.8

35.6

35.4

36.0

40.1

m 36.8

Z 26.0

$$2 - m - 10.8 = -0.247$$

$$b = +0.103$$

$$\text{Col. m.w.} = -0.144$$

E	W
+70.4	90.4
70.0	91.2
89.0	+72.0
88.8	72.1
88.2	72.4
88.2	72.4
+68.7	91.6
68.8	91.5
632.1	653.6
79.01	
81.70	
2.69	
1.34	

Intervals of Wires insulated Dec 5, 1860

	A to B	B to C	C to D	D to E	wt.	
1862 Polaris Jan 31	+ 3.268	+ 3.615	- 3.045	- 3.491	2.5	1
Sun. Mar 7 5	+ 3.203	+ 3.630	- 3.055	- 3.405	2.0	0.8
Polaris Feb. 7	+ 3.251	+ 3.529	- 3.143	- 3.492	2.5	
Sun. Mar 7 7	+ 3.215	+ 3.601	- 3.097	- 3.429	2.0	

Stuiv's formula for the prob. Error of observing the transit over a single wire is

$$\eta = \sqrt{0.072 + \left(\frac{180}{g} \cdot 0.016 \sin \delta\right)^2}$$

0.072 is this Error of the Ear and the second term under the radical that of the sight, g being the magnifying power employed.

From this formula the relative weights of Polaris and Sirius in transit will be

for Polaris 2.51 for Sirius 1.82

XG 11365.112

