

KG
11366
v. 775

Comparison of Waltham Clock with
Sutton Clock.

July 3 1871

α Ursae Min.

h	m	s	s	s
14	49	47.3	29.9	12.8
		51.0	83.7	16.8
		54.8	87.7	20.7
		58.7	41.6	24.3
		2.4	45.8	28.2
		6.3	49.5	32.1
		10.3	53.3	36.1
		14.1	57.2	40.0
		18.2	1.1	44.0
		2.67	45.50	28.33
		45.50		
		28.33		

50 45.50

51 8.26

-22.96

ε Serpentis

h	m	s	s	s
15	44	8.6	15.0	26.3
		5.7	17.0	28.5
		7.8	19.0	30.5
		9.8	21.2	32.6
		11.9	23.2	34.7
		7.16	19.08	30.52
		19.08		
		30.52		

44 19.12

44 47.57

-28.25

S Bootis

h	m	s	s	s
15	09	52.0	5.7	19.3
		54.5	8.1	21.8
		57.0	10.7	24.2
		59.6	13.1	26.7
		2.0	15.6	29.2

α Ursae Min.

h	m	s
15	49	22.5
		26.1
		29.3
		32.6
		36.0
		39.6
		42.7
		46.0
		49.5

α Serpentis

h	m	s	s	s
15	37	25.0	46.3	5.7
		27.0	48.5	10.0
		29.1	50.6	14.0
		31.2	52.7	18.0
		33.2	54.7	22.0

39.10 50.56 1.98

50.56

1.98

37 50.55

38 18.73

-28.18

Comparison of
Waltham Clock
with South (?)
Clock

ε Bootis

15 5

$$15 38 \quad 0 = -28.18 + 12 - 1.9 \quad -28.3$$

$$15 44 \quad -28.25 + 0.9 - 1.5 \quad 40$$

$$15 53 \quad -27.70 + 52 - 81 \quad .51 + 1 \quad .50$$

$$15 45 \quad 0 = -28.04 + 2.4$$

$$0 = +5.28 + 3.40 \quad n = -1.55$$

$$+4.51 + 2.88 \quad -1.57$$

$$-1.5h$$

$$b = +0.5$$

$$m = +.07 + 1.42 = +1.49$$

$$15 45 \quad dr+m = +28.43$$

$$m = +1.49$$

$$dr = +26.94$$

July 3 1871

B. Minae Min.

h	m	s	s'	s'
14	49	47.3	29.9	12.8
		51.0	33.7	16.8
		54.8	37.7	20.7
		58.7	41.6	24.3
		2.4	45.5	28.2
		6.3	49.5	32.1
		10.2	53.3	36.1
		14.1	57.2	40.0
		18.2	1.1	44.0
		2.67	45.0	28.33
		45.50		
		28.33		

50 45.50

51 8.26

-22.96

S. Bortis

h	m	s	s'	s'
15	49	52.0	57	19.3
		54.5	81	21.8
		57.0	107	24.2
		59.6	131	26.7
		2.0	15.6	29.2
		57.02	106.4	24.4
		10.64		
		24.24		

10 10.63

59

B. Minae Min.

h	m	s
15	49	22.5
		26.1
		29.3
		32.6
		36.0
		39.6
		42.7
		46.0
		49.5

49 36.04

20 58.57

-23.53

S. Serpenti

h	m	s	s'	s'
15	37	35.0	46.3	57.8
		37.0	48.5	0.0
		39.1	50.6	2.0
		41.2	52.7	4.0
		43.2	54.7	6.1

39.10 50.16 19.8

50.56

19.8

37 50.55

38 18.73

-28.18

S. Serpenti

h	m	s	s'	s'
15	44	86	15.0	26.3
		57	17.0	28.5
		78	19.0	30.5
		98	21.2	32.6
		11.9	23.2	34.7
		7.76	19.08	30.52
		18.08		
		30.52		

44 19.12

44 47.37

-28.25

S. Coronae.

h	m	s	s'	s'
15	52	50.4	31	16.0
		52.7	54	18.2
		55.0	78	20.5
		57.3	101	22.8
		59.1	125	25.1
		54.90	7.78	20.52
		7.78		
		20.52		

51 7.73

52 35.43

-27.70

h = -0.009

$$h = 15.38 \quad 0 = -28.18 + 12 - 19 \quad -28.37 - 1 - 28.38 \quad 0 = -22.96 + 3.64$$

$$15.44 \quad -28.25 + 0.9 - 15 \quad 40 - 0 \quad 40 \quad -23.58 + 3.12$$

$$15.53 \quad -27.70 + 52 - 81 \quad 51 + 1 \quad 50$$

$$15.45 \quad 0 = -28.04 + 2.4$$

$$0 = +5.28 + 3.40 \quad m = -1.55$$

$$b = +0.5$$

$$+4.51 + 2.88 \quad -1.57$$

$$m = +.07 + 1.42 = 1.49$$

$$h = 15.45 \quad dt + m = +28.43$$

$$-1.57$$

$$m = +1.49$$

$$dt = +26.94$$

4
 Aug 3 1878

Waltham Clock = W.C.

North Clock = N.C.

South Clock = S.C.

Readings of 1st 20 seconds of each minute of W.C. and N.C.
 in terms of South Clock. $\square$

W.C. N.C.
 17 15 18.43 17 24 15.86

20.46 17.87

22.47 19.88

24.49 21.88

26.52 23.90

28.52 25.91

30.53 27.92

32.52 29.95

34.53 31.93

36.53 33.93

17 15 38.53 35.95

17 15 38.50 = 37.91 =

17 +26.81 +26.80

17 15 58.31 17 24 54.71

6 46 17.20 6 46 17.20

10 29 38.11 9 10 35 37.51

9 30 24.89 - 1 44.13

10 27 54.98 10 33 53.38

S.C. = 10 27 54.98

N.C. = 10 28 10.00

-(S.C. - N.C.) +15.02

S.C. = 10 33 53.38

N.C. = 10 34 10.00

N.C. - S.C. +16.62

July 4/1878

h ~ Agüero
 1 59 384 506 30
 40.7 530 53
 43.0 55.2 75
 45.1 575 98
 47.3 597 120

42.90 55.20 7.52

55.20
7.52

1 59 55.21

2 0 19.16

-224.65

n = -1.56

0 = +24.65 + 42.66 - 25.31

dT + m = +25.31 at 2^h 0^m

m = +1.49

dT = +23.82 at 2^h 0^m July 4

dT = 26.94 at 15 45 July 3

dT = 3.12 for 35.25

h = -0.89

W.B.
1^h 37^m 39.50

41.52

43.55

45.53

47.54

49.52

51.55

53.55

56.55

57.53

59.54

1 37 49.53
+23.79

1 38 13.32

6 50 13.76

18 47 59.56

-3 4.80

18 44 54.76

N.B.
1^h 44^m 39.22

41.20

43.23

45.22

47.23

49.22

51.23

53.24

55.25

57.25

59.25

44 49.23
+23.80

1 44 13.03

6 50 13.76

18 53 58.25

-3 5.78

18 50 53.49

S.L. = 11^h 44^m 54.76 S.C. = 18^h 50^m 53.49

W.B. = - 10.00 N.C. = - 10.00

A.B.

N.C.-S.L.

+15.24 A.B.-S.L. = +16.51

Woo. Min.

15 19 52.9

56.5

59.9

3.1

6.7

10.1

1878, July 7

y² loss min.

X	m	s			
15	19	52.9	20	30.3	21 7.6
		56.5		33.7	11.1
		59.9		37.2	14.5
		3.1		40.3	17.8
		6.7		43.8	21.2
		10.1		47.3	24.4
		13.3		50.6	27.8
		17.0		54.0	31.3
		20.1		57.1	34.7

 α Coronae

28	45.0	28	57.7	10.4	23.1
	47.2	29	0.0	12.7	25.6
	48.5		2.3	15.1	28.0
	51.8		4.7	17.4	30.1
	54.2		7.0	19.7	32.5

 ϵ Serpentis

44	82.0	23.3	34.7
	14.0	25.4	36.8
	16.0	27.5	38.9
	18.1	29.6	41.0
	20.2	31.6	43.0

15	19	6.622	43.811	21.156
		43.81		
		21.16		
20		43.90		
20		59.36		
		-18.46		

29	2.340	15.060	27.860	44	18.60	27.480	38.880
	15.06				27.48		
	27.86				38.88		
29	15.09			44	27.47		
	34.38			44	47.36		
29	19.29				-19.89		

 ϵ Coronae

15	51	58.7	11.5	24.2
		1.0	13.8	26.4
		3.3	16.0	28.9
		5.6	18.3	31.1
		8.0	20.7	33.6

51	3.320	16.060	28.840
	16.06		
	28.84		

51	16.07
51	35.40
	-19.33

15	29	0 = -19.29 + 0.7 - 7.4 - 20.03	15	20	0 = -15.46 + 8.12
15	41	-19.89 + 0.8 - 1.3			-0.3
15	52	-19.33 + 0.8 - 7.6			0 = -15.49 + 3.12
		0.09			
15	42	0 = -19.50 + 0.7	20.04		0 = +4.01 + 2.75

0 = -15.46 + 8.12
-0.3
0 = -15.49 + 3.12
0 = +4.01 + 2.75
n = -14.6

$$\begin{aligned}
 d\tau + m &= +20.04 \quad \text{of } 15 \text{ } 42 \\
 &+ 1.40 \\
 d\tau &= +18.64 \quad \text{July} \\
 &+ 26.94 \quad \text{" } 3 \\
 &\hline
 8.30 &= 4.0 d. \\
 4d\tau &= -2.08 \\
 h &= -0.87
 \end{aligned}$$

$$m = +0.7 + 13.3 = +14.0$$

18 July 8
Vera. Min.

15	19	55.3	32.4	9.9
		58.6	35.9	13.1
		1.9	39.2	16.6
		5.2	42.7	19.8
		8.7	46.0	23.3
		12.0	49.3	26.5
		15.4	52.8	30.0
		18.9	56.3	33.4
		22.2	59.6	36.8

8.689 46.022 23.300
46.022
23.300

20 46.00
20 58.30
-13.30

z Vera. Min.
z Vera. Min.

15	47	5.1	0.3	55.4
		10.0	5.5	0.8
		15.0	10.3	5.7
		19.5	15.2	10.7
		25.0	20.6	15.7
		30.1	25.5	21.0
		35.2	30.3	26.0
		40.6	35.5	31.1
		45.3	40.7	36.2

25.089 20.433 15.844
20.433
15.844

20.45
36.77
-10.32

α Coronae

28	47.0	59.7	12.3	25.1
	49.3	2.0	14.7	27.6
	52.6	4.2	17.0	29.8
		6.7	19.4	32.0
		9.0	21.7	34.5

432 17.02 29.80
17.02
29.80

17.05
34.37
-17.32

α Serpentis

37	45.4	56.5	8.1
	47.4	58.9	10.2
	49.5	1.0	12.3
	51.6	3.1	14.4
	53.7	5.1	16.5

49.52 0.98 12.30
0.98
12.30

0.93
18.71
-17.78

ε Serpentis

44	14.0	25.3	36.7
	16.0	27.4	38.8
	18.1	29.6	41.0
	20.1	31.6	43.0
	22.2	33.7	45.1

18.08 29.52 40.92
29.52
40.92

29.51
47.35
-17.84

ε Coronae

52	0.7	13.5	26.1
	3.0	15.7	28.6
	5.3	18.1	30.9
	7.7	20.5	33.2
	10.0	22.7	35.5

5.34 18.10 30.86
18.10
30.86

18.10
35.39
-17.29

$$\begin{aligned} 1529 & 0 = -17.32 + 51 - 77 - 18.09 \\ 1587 & +7.28 + 12 - 18 \quad 17.96 \\ 1548 & -17.32 + 09 - 14 \quad 17.93 \\ 1552 & -17.29 + 52 - 81 \quad 18.10 \\ 1541 & -17.43 + 31 \quad 18.02 \end{aligned}$$

$$\begin{aligned} d\Gamma + m &= +18.02 \\ m &= +1.48 \end{aligned}$$

$$\begin{aligned} d\Gamma &= +16.54 \text{ for } 1541 \\ Ad\Gamma &= -2.10 \\ u &= -0.88 \end{aligned}$$

$$\begin{aligned} 1520 & 0 = -17.32 + 13.12 - 13.27 \\ 1548 & -10.32 + 9.76 - 10.33 \end{aligned}$$

$$\begin{aligned} 0 &= +4.16 + 2.81 \quad n = -1.49 \\ &+ 7.90 + 4.45 \quad 1.60 \\ &-1.55 \end{aligned}$$

$$m = +0.7 + 1.41 = +1.98$$

W.C.			W.C.			W.C.			W.C.		
h	m	s	h	m	s	h	m	s	h	m	s
12	45	23.40	17	42	12.37	2	4	35.40	4	47	1.46
		25.50			14.37			37.40			3.46
		27.43			16.34			39.42			5.48
		29.43			18.39			41.42			7.45
		31.44			20.38			43.40			9.47
		33.45			22.40			45.41			11.48
		35.46			24.40			47.40			13.48
		37.45			26.39			49.42			15.49
		39.48			28.40			51.41			17.50
		41.46			30.41			53.42			19.50
		43.48			32.41			55.42			21.51
		33.453			22.387			45.411			11.480
		+16.10			+16.37			+15.62			+15.39
12	45	50.25	17	42	38.76	2	5	1.03	4	47	26.87
7	5	59.98	7	5	59.98	7	5	59.98	7	5	59.98
18	20	9.73	23	21	22	18	59	1.05	21	41	26.89
5	39	50.27	10	36	38.78	-	3	5.60	-	3	33.21
-	-	58.83	-	1	44.30	18	53	54.45			
5	38	54.44	18	34	54.48	18	55	54.45	21	39	53.68
5	39	10.00	10	35	10.00	18	56	10.00	38		10.00
		+15.46			+15.32			+15.35			+16.32

1878 July 9
Herculis

16	15	30.7	47.1	37
		33.7	50.3	6.7
		36.8	53.6	9.8
		39.8	56.2	12.8
		42.7	59.2	15.9

of Draconis

21	38.0	2.0	25.9
	40.0	4.1	28.2
	42.2	6.3	30.2
	44.6	8.7	32.5
	46.7	10.9	34.6
	48.8	12.9	37.0
	51.0	15.0	39.0
	53.2	17.2	41.3
	55.5	19.5	43.6

E. Ursa. Min.

56	37.5	1.5	25.7
	45.0	9.7	33.2
	52.7	16.8	41.1
	0.0	24.1	48.1
	7.8	32.3	56.0
	15.8	39.1	3.7
	23.6	47.6	11.7
	30.9	54.8	19.0
	38.2	2.3	26.7

α Herculis

8	37.1	48.9	0.4
	39.3	51.0	2.6
	41.4	53.1	5.0
	43.5	55.2	7.0
	45.7	57.4	9.1

36.74	53.28	9.78
53.28		
9.78		

46.67	10.733	34.700
10.733		
34.700		

7.944	32.022	56.133
32.022		
56.133		

41.40	53.12	4.82
53.12		
4.82		

15 53.27

10.70

32.03

53.11

16 7.52

28.65

36.14

8.45

- 14.25

- 13.95

- 4.11

- 15.34

h ~
 16 16 0 = -14.25 + 1.06 -170 -15.95.
 16 23 [-12.95 + 1.07] -299 -15.94
 17 9 -15.34 + .26 -0.42 15.76
 16 36 15.88

0 = -4.11 + 7.29
 0 = -15.34 + 26
 0 = +11.23 7.03 n = -1.60
 b = +1.0
 m = +13 + 1.46 = +1.59

$$d\tau + m = +15.88$$

$$m = +1.59$$

$$d\tau = +14.29$$

$$4d\tau = 2.06$$

$$h = .086$$

Aug 10 1870

2 Musc. Min.

2 Corone

2 Serp. Lul.

h	m	s		
15	9	6.5	203	34.0
		9.0	22.7	36.4
		11.5	25.3	39.0
		14.1	27.7	41.4
		16.7	30.1	43.9

h	m	s		
15	19	59.1	36.7	14.5
		3.0	40.1	17.6
		6.2	43.6	20.6
		9.7	47.0	24.1
		13.0	50.3	27.5
		16.4	54.0	30.9
		19.8	57.5	34.6
		23.1	0.8	38.0
		26.5	4.1	41.2

h	m	s		
11	29	4.0	16.7	28.6
		6.2	19.1	31.8
		8.6	21.3	34.1
		11.0	23.7	36.5
		13.2	26.1	38.9

h	m	s		
11	37	49.7	1.1	12.4
		51.7	3.1	14.6
		53.8	5.3	16.7
		55.9	7.2	18.7
		58.0	9.2	20.8

11.56 26.22 38.94

12.978 50.456 27.667

8.60 21.38 34.18

53.82 5.18 16.64

20 27.667

21.38
34.185.18
16.64

20 50.37

21.39

15.21

20 69.19

34.35

15.70

-8.82

-12.96

12.49

2 Serpentes

2 Musc. Min.

h	m	s		
15	44	18.2	29.7	41.0
		20.3	31.7	43.2
		22.3	33.8	45.2
		24.5	35.9	47.3
		26.6	38.0	49.4

h	m	s		
47	9.1	4.1	59.3	
	13.8	9.1	5.3	
	18.6	14.3	10.7	
	24.0	19.4	15.3	
	29.0	24.2	20.0	
	33.8	29.8	25.0	
	39.1	35.1	29.9	
	44.3	39.7	34.9	
	49.0	44.7	39.7	

22.38 33.82 45.22

28.967 24.489 20.011

28.57 26.1

53.81

83.82
40.2224.489
20.011

45 18.565 52.620

58.416

43.782

45.605

38.81

24.49

12.01 + 12.23

+ 12.19

+ 11.23

+ 11.22

47.34

30.59

17 45 30.57 15 4.85

15 42 10.61

2 19 55.01

2 26 56.02

-13.53

-6.10

13 53.10 7.13 52.10

7 13 53.10

7 13 53.10

7 13 53.10

10 31 37.47 7.53 11.75

8 28 17.51

19 6 18.1

19 13 3.72

10 29 54.10 7.61 84.23

8 26 54.41

19 2 54.16

19 9 54.82

10 10.00 10.00

10.00

10.00

10.00

+16.00 +15.77

+15.59

+15.84

+15.18

$$0 = -12.96 + 51 - 76 - 13.72$$

$$0 = -8.82 + 3.12$$

$$-12.89 + 12 - 18 .67$$

$$-6.10 + 4.71$$

$$-13.53 + 0.9 - 14 .67$$

$$12.99 + 24$$

$$0 = +4.17 + 2.88$$

$$13.69$$

$$+6.89 + 4.47$$

$$m = +1.50$$

$$m = -1.50$$

$$d\Gamma + m = +13.69$$

$$m = +13 + 13 = +1.50$$

$$d\Gamma = +12.19$$

$$4d\Gamma = -2.17$$

$$\text{Waltham Clock} = +15.79 \text{ at } 16.11$$

$$= +15.84 \text{ at } 20$$

July 11 1878

The Waltham Clock, failing to break the ^{short} circuit - in the clock
room, it was examined and the break circuit - control - was
found to be oxydized. Stopped clock and remedied the
difficulty. This will probably account for the trouble
with the companions on July 10. J. S. R.

Clock supposed to be started coincident with N.C.C. M.T.
clock 394

1878, July 15

γ Usc. Min.

α Coronae

α Serpenti

ζ Usc. Min.

15 20 10.2 47.8 25.0
 13.8 50.8 28.2
 17.4 54.7 31.6
 21.0 57.8 35.0
 24.6 1.1 39.0
 27.8 4.3 41.9
 30.9 7.6 45.1
 34.5 11.1 48.7
 37.0 14.6 51.8

29 14.8 27.6 40.2
 17.2 29.7 42.9
 19.5 32.0 45.1
 21.7 34.6 47.4
 24.0 36.8 49.7

38 0.5 11.9 23.4
 2.5 14.0 25.5
 4.6 16.0 27.4
 6.6 18.1 29.6
 8.8 20.2 31.6

47 20.0 15.7 10.1
 24.3 19.5 15.9
 30.0 24.3 21.8
 34.2 30.3 25.7
 40.2 35.1 30.2
 44.8 39.5 35.6
 49.9 44.5 40.2
 54.6 49.8 45.7
 58.0 55.1 51.0

24.133 1.089 38.478
 1.089
 38.478

19.440 32.140 45.060
 32.140
 45.060

46.00 16.040 27.800
 16.040
 27.800

39.667 34.867 30.689
 34.867
 30.689

21 1.29

29 32.21

38 16.05

47 35.07

20 58.51

29 54.30

38 16.66

49 30.13

+ 27.2

- 20.9

- 26.1

- 4.84

ε Coronae

52 16.0 28.7 41.4
 18.3 31.0 43.7
 20.7 33.3 46.0
 23.0 35.7 48.2
 25.1 38.0 50.6

W. C.

W. C.

W. C.

12 49 9.87
 11.88
 13.86
 15.80
 17.88
 19.88
 21.90
 23.89
 25.90
 27.90
 31.91

15 59 41.40
 43.40
 45.40
 47.42
 49.41
 51.42
 53.41
 55.41
 57.43
 59.43
 1.44

18 7 2.37
 4.40
 6.40
 8.43
 10.43
 12.42
 14.41
 16.42
 18.43
 20.43
 22.43

20.620 33.500 45.980
 33.500
 45.980

19.89
 20.620

51.415

12.415

52 33.37

12 49 21.40
 7 33 36.89
 5 15 34.51
 51.72
 5 14 52.78

15 59 52.62
 7 33 56.89
 8 16 22.84
 43.95
 22.84
 8 24 52.79

18 7 13.43
 7 33 36.89
 10 30 36.54
 1 43.79
 10 31 52.75

52 35.32

5 14 52.78

8 24 52.79

10 31 52.75

- 1.95

15 29

0 = - 2.09 + 57.52

- 2.51 + 17.21

+ 17.21

+ 17.25

15 38

- 2.61 + 12.19

.80

15 52

- 1.95 + 52.83

.78

47 + m = + 2.83

at 15 40

15 40

- 2.22 + 38

m = + 1.59

dr = + 1.24

4dr = - 2.19

h = - .091

0 =

0 = + 2.72 + 3.12

0 = + 4.94 + 2.74

m = 1.50

+ 4.94 + 4.76

= + 7.16 + 5.19

= 1.40

m = + 1.3 + 1.46 = + 1.58

17.22

1878, July 16
Serpentis

E Serpentis

Z Ursa. Min

E Coronae

15 38 2.5 13.7 25.1
 4.6 15.9 27.3
 6.5 18.0 29.4
 8.6 20.0 31.5
 10.7 22.1 33.6

44 31.1 42.4 53.8
 33.1 44.6 56.0
 35.2 46.7 58.0
 37.2 48.7 1.1
 39.4 50.7 2.1

47 21.0 15.4 11.6
 26.0 20.6 16.1
 30.8 26.0 20.9
 35.7 31.0 26.1
 40.8 36.0 31.1
 45.7 40.6 36.5
 52.0 45.7 41.7
 55.4 51.5 46.4
 1.1 55.7 52.0

52 17.7 30.6 43.3
 20.0 32.9 45.7
 22.3 35.2 47.8
 24.7 37.6 52.2
 27.0 39.7 52.5

6.580 17940 29.380
 17.94
 29.38

35.200 46.620 58.200
 46.62
 58.20

40.944 35.767 31.378
 30.767
 31.378

22.340 35.200 47.900
 35.20
 47.90

38 17.97
 18.60
 -0.68

45 46.67
 47.30
 -0.63

48 36.03
 39.04
 +5.99

52 35.15
 35.81
 -0.16

W.6.
 17 37 15.67
 17.70
 19.70
 21.69
 23.68
 25.71
 27.71
 29.73
 31.76
 33.76
 35.78

W.6
 16 0 39.44
 41.45
 43.45
 45.43
 47.43
 49.43
 51.45
 53.46
 55.45
 57.45
 59.45

25.717
 -0.70

49.445
 -1.88

13 34 24.02

16 0 47.56

7 37 32.45

7 37 32.45

5 59 51.57

8 23 15.11

0 58.96

1 22.44

5 58 52.61

8 21 52.67

5 59 10.00

10.00

17.39

17.33

17.36

$$15\ 39\ 0 = -0.68 + 12 - 17 - 0.85$$

$$0 = +5.99 + 4.76$$

$$15\ 45\ -0.63 + 0.9 - 13 - 0.76$$

$$15\ 52\ -0.16 + 5.2 - 7.6 - 0.92$$

$$0 = +6.48 + 4.52$$

$$15\ 45\ -0.49 + 2.4 - 0.84$$

$$n = -1.46$$

$$dr + m = +0.14$$

$$m = +1.3 + 13.3 + 1.46$$

$$m = +1.46$$

$$dr = -0.62$$

$$4dr = -1.86$$

$$dr = -0.978$$

July 17

72 Ophiuchi			p. Serpens		
18	1	34.8	18	15	00.8
		37.0			30
		39.1			5.0
		41.1			7.1
		43.3			9.2

18	1	39.06	15	5.02
	1	37.47	15	3.16
		+1.59		+1.46

$$n = -1.50$$

18	2	$0 = +1.59 + 16 - 24 + 1.35$		
18	15	$+1.46 - 0.5 + 4 + 1.50$		
18	8	$+1.42$		

$$d\bar{r} + m = -1.42$$

$$m = +1.46$$

$$d\bar{r} = -2.88$$

$$(26.5) 4d\bar{r} = -2.76$$

$$h = -0.85$$

$$4d\bar{r} = -2.02$$

p. C.		
18	26	13.8
		3.38
		5.40
		7.40
		9.40
		11.42
		13.42
		15.43
		17.42
		19.44
		21.45

18	26	11.40
		-2.88
18	26	8.52
7	41	29.00
10	44	38.52
		43.62
10	42	53.80
		43 10.00
		+16.10

16

July 1878

W.C.

13^h 54^m 14.51

16.22

18.46

20.46

22.45

24.46

26.45

28.47

30.47

32.48

34.49

13 54 24.46

-4.58 (4.58)

13 54 19.88

7 45.25.56

6 08 54.32

1 00.43

6 3 58.88

10.00

W = +16.00

July 19 1878

α Lyrae.	ln. 26 40	ϵ Lyrae	β Lyrae
18 32 51.3	23.8	22.6	39.4
58.8	43.5	25.3	42.0
58.0	58.3	28.0	44.5
1.1	26	30.8	46.9
3.7	11.8	33.4	49.5
18 32 58.44	35 53.00	40 28.00	45 44.46
18 32 51.71	18 55 52.98	40 21.02	45 37.77
+6.73	+0.02	+6.98	+6.69

$$m = 4.46$$

$$\begin{aligned} o &= +6.73 + .80 - .112 & +6.61 \\ &+6.98 + .82 - .115 & 6.83 \\ &+6.69 + .65 - .91 & 5.78 \\ & & +5.74 \end{aligned}$$

$$d\Gamma + m = -5.74$$

$$m = +1.46$$

$$d\Gamma = -7.20$$

$$4d\Gamma = -2.16$$

km	s
18 50	140
	3.39
	5.40
	7.37
	9.40
-	11.42
	13.42
	15.42
	17.42
	19.42
	21.43

$$\begin{aligned} 18 & 50 & 12.41 \\ 7 & 49 & 22.12 \\ 11 & 00 & 59.29 \end{aligned}$$

$$\begin{aligned} 18 & 50 & 14.21 \\ 7 & 49 & 22.12 \end{aligned}$$

$$\begin{aligned} 11 & 00 & 42.09 \\ -1 & & 48.25 \\ 10 & 48 & 53.84 \\ 10 & 48 & 10.00 \\ +16.16 \end{aligned}$$

July 20 1878

Journal Mini

x Cronne

h m s

h m s

15 30 57.4

15 29 38.0

0.6

401

41

426

41

448

102

471

142

175

210

250

21 44.56

29 42.52

10.79

20 58.53

29 34.23

+12.23

+8.29

$$0 = +8.29 + 5.1$$

$$0 = +12.23 + 3.12$$

$$0 = +29.4 + 2.61$$

$$n = -1.07$$

$$m = +1.3 + 1.37 = +1.50$$

$$4d\tau = -2.09$$

$$h = -0.87$$

$$d\tau + m = -8.29 + 76 = -753$$

$$m =$$

$$d\tau =$$

$$+1.50$$

$$+9.03$$

W.C.

h m s

15 36 15.5

27.37

22.9

29.38

28.0

31.58

23.0

33.38

21.0

35.38

11.32

37.39

13.28

39.40

45.32

41.40

17.35

43.41

19.35

45.41

27.36

47.41

15 36 11.31

37.39

-9.04

9.04

15 36 22.7

28.35

7.53

18.72

43

43.55

89.63

-1

15.41

15.47

7.41

27.74

83.76

$$+16.24$$

$$W.C. = +16.24$$

1878, July 24

E Ursa. Min.

16 58 32.0
39.2
47.3
54.7
2.1
10.0
17.1
25.5
32.8

16 58 2.300

16 58 2.30
58 34.24
+34.84
28.06

M. C.

18 25 47.36
49.40
51.40
53.42
55.41
57.42
59.41
1.42
3.42
5.44
7.44

18 25 57.41
-18.57

18 25 38.84
8 9 4.91
10 16 33.93
1 41.02

10 14 52.91
15 10.00

+17.09

* h = +.21

AdT = +.11088

α Ophiuchi

17 29 21.2 32.8 44.5
23.3 34.9 46.7
25.4 37.1 48.7
27.5 39.3 50.9
29.7 41.3 53.1

25.42 37.08 48.78
3.708
48.78

17 29 37.09
29 19.66
+17.43

γ Draconis

53 43.6 1.7 20.0
46.8 5.0 21.4
50.0 8.3 26.7
53.6 11.7 32.0
56.8 15.0 33.4

50.16 8.34 26.30
8.34
26.30

17 54 8.27
53 19.17
49.55
+18.72
+5.28

δ Ursa. Min.

18 11 18.7
35.1
54.4
12 10.1
27.8
45.6
13 2.2
19.7
37.9

12 27.944

18 12 27.94
11 44.81
+43.13

$$0 = +17.43 + 22.34 + 17.09$$

$$+18.72 + 1.26 - 1.85 + 12.77$$

$$0 = 16.07 + 0.74 + 16.93$$

$$dT + m = -16.93$$

$$m = +1.54$$

$$dT = -18.47$$

$$AdT = -2.30$$

$$h = -0.96$$

$$0 = +34.84 + 7.21$$

$$+43.13 + 16.84$$

$$0 = +18.57 + 6.51 = 25.08$$

$$+25.06 + 16.20 = 41.26$$

$$-1.55$$

$$m = +1.54$$

Aug 29/188 J. R. M. des.

Shae Min	109 Mercuris	Lyne	W.C.	W.C.
h m s	h m s	h m s	h m s	h m s
6 11 55.0	18 18 52.5	18 32 10.7	16 46 24.30	18 47 44.30
12 12.8	54.8	13.5	26.28	46.32
12 29.0	59.0	15.9	28.29	48.32
12 48.6	59.3	18.7	30.31	50.35
13 5.6	1.8	21.0	32.31	52.33
			34.32	54.33
			36.32	56.35
			38.32	58.35
			40.32	0.42
			42.33	2.38
			44.34	4.38

12.3020

18 57.02

32 57.63

16 46 34.31

18 47 54.35

11 42.90

18 33.29

32 57.63

16 46 34.31

18 47 54.35

+46.30

+23.73

25.57

16 46 9.83

18 47 29.69

8 20 54.58

8 20 54.58

8 25 15.25

10 26 35.11

8 23 52.48

10 24 52.46

+17.52

+17.54

$$0 = +23.73 + 40.54 + 23.19$$

$$0 = +46.30 + 16.94$$

$$+24.43 + 80.109 \quad 23.34$$

$$\text{Error of W.C.} = +17.53 \text{ at } 17^{\text{h}} 17^{\text{m}}$$

$$\text{Rate} = +1.5$$

$$0 = +24.08 + 60$$

$$0 = +22.22 + 16.34m$$

$$m = -1.36$$

$$m = +13 + 124 = +1.37$$

$$d\tau + m = -23.26$$

$$m = +1.37$$

$$d\tau = -24.63 \text{ at } 18^{\text{h}} 26^{\text{m}} \text{ Aug } 27$$

$$d\tau = -18.47 \text{ " } 17^{\text{h}} 41^{\text{m}} \text{ Aug } 26$$

$$Ad\tau = -2.04$$

$$h = -.086$$

Aug 28 1878 M.R. obs.

α Hercules

h	m	s	s	s
17	9	18.1	29.8	41.7
		20.2	32.0	43.8
		22.4	34.2	45.9
		24.6	36.3	48.0
		26.7	38.5	50.2

α Ophiuchi

m	s	s	s
29	29.7	41.2	52.8
	31.7	43.3	55.0
	33.8	45.4	57.0
	35.8	47.6	59.2
	38.0	49.7	1.5

α Lyrae
γ Draconis

s	s	s	s
32	58.6	13.2	27.7
	1.2	15.7	30.2
	3.8	18.3	32.9
	6.5	21.0	35.5
	9.1	23.6	38.2

δ Cass. Min.

s	s	s	s
11	27.0		
	43.8		
12	2.5		
	19.0		
	37.0		
	53.7		
13	11.6		
	28.8		
	45.2		

22.40 34.16 45.92
34.16
45.92

33.80 45.44 57.10
45.44
57.10

3.84 18.36 32.90
18.36
32.90

36.51

9 34.16

29 45.45

18.37

12 36.51

9 8.35

19.64

51.66

11 43.60

+2581

+2581

+26.71

+0281

W.C.

17

W.C.

h	m	s
17	1	24.63
		26.66
		28.66
		30.68
		32.69
		34.72
		36.72
		38.73
		40.72
		42.72
		44.72

W.C.

h	m	s
18	38	40.78
		42.79
		44.79
		46.78
		48.79
		50.79
		52.80
		54.80
		56.81
		58.82
		0.82

17 1 34.69

18 38 50.80

17 1 57.2

18 38 23.67

8 24 51.14

8 24 51.14

8 26 18.78

10 13 32.53

1 24.58

10 11 40.81

34 52.00

10 11 52.02

+18.00

17.98

17.9 0 = +2581 + 26.43 + 25.38

0 = +52.91 + 16.94

17.29 +2581 + 26.43 + 25.38

0 = +26.80 + 16.11

18.32 +26.71 + 50.13 + 38

n = -1.66

0 = +26.11 + 43

25.40

m = +1.3 + 1.17 = +1.64

dT + m = -25.40

m = +1.64

dT = -27.04 17 17 43

4dT = -24.7

Dray W.C. = +17.99 at 17 50

From Aug 24 Rate = +.22

22

1878, July 31

E. Urs. Minoris.

X Ophiuchi.

Y Draconis.

45.5		47.5		16.5		
53.8		49.7		20.0		
2.5		51.9		23.3		
9.2		54.0		26.6		
17.1		56.0		29.7		
24.4	29		54			
32.8						
40.2						
59	47.0					
59	16.94	29	51.82	54	23.22	
58	33.38	17	29	19.62	53	49.30
43.56		23	2.20		33.92	

$$32.20 + .22n + \Delta + m$$

$$33.92 + 1.26n + \Delta + m$$

$$\text{Mean} = 33.06 + .74n + \Delta + m$$

$$P = 43.56 + 7.29n + "$$

$$10.50 + 6.55n$$

$$n = -1.60$$

$$m = .13 + 1.46 = 1.59$$

$$32.20 - .35 + 1.59 = 32.85 + 1.09 = 33.44$$

$$33.90 - 2.01 + 1.59 = 31.89 + 1.59 = 33.48$$

$$\text{July 21. } 17^h 41^m \Delta t = -23.46$$

$$\Delta t =$$

$$\text{July 28. } 17^h 41^m \Delta t = -27.04$$

$$6.42$$

$$2\Delta t = -2.14$$

$$h = -0.89$$

M.C.		M.C.	
16	31	18	2
	13.25		28.29
	15.26		30.30
	17.27		32.29
	19.28		34.30
	21.26		36.31
	23.27		38.31
	25.27		40.32
	27.28		42.33
	29.28		44.34
	31.30		46.34
	33.29		48.38
	78		21

16	31	23.297	18	2	38.328
		-33.36			33.49
16	30	49.91	18	2	44.83
8	36	40.80	8	36	40.80
7	54	9.11	7	25	20.03
	1	17.67		1	32.63
7	52	51.44	7	23	51.40
		+ 18.56			+ 18.60

$$\text{Error M.C. at } 8^h 38^m = +18.58$$

$$\text{From July 28th rate} = +.20$$

1878. Aug 14th

<i>E. Ursae. Minoris.</i>	<i>K Cygni.</i>	<i>B Cygni.</i>	<i>V. Aquilae.</i>	
15.6		51.9	31.7	
23.0	19.1			
29.8	23.0	54.3	33.8	
37.8		56.7	36.0	14
46.2	26.4	59.0	38.1	25
53.2	29.8	1.3	40.2	
0.7	15 33.3			
9.0				
0 16.7				
23.0	26.32	56.64	35.96	40
18 59 45.78				37.9
18 11 58.31	19 14 19.76	19 25 51.44	19 40 31.26	
16 58 30.99	66.56	65.20	64.70	
1 14.79				

$$\text{True Stars: } 0 = 66.56 + 1.33w + 4t + m \quad 0 = 66.56 - 1.91 + 1.44 = 66.09$$

$$0 = 65.20 + .52w + " \quad 0 = 65.20 - .75 + 1.44 = 65.90$$

$$0 = 64.70 + 1.8w + " \quad 0 = 64.70 - .26 + 1.44 = 65.86$$

$$\text{Mean } 0 = 65.29 + .68w + " \quad \text{at } 19^h 26^m \quad 4t + m = 65.95$$

$$\text{Polaw Eq.} \quad 0 = 74.79 + 7.29w + "$$

$$0 = 9.50 + 6.61w$$

$$w = -1.44$$

$$m = +1.44$$

19 ^h	55	21.18	54	21.0
		23.19		23.0
		25.21		
		27.24		
		29.24		
		31.25		
		33.25		
		35.26		
		37.27		
		39.28		
		41.27		
		46		
19	55	31.24		
		+66.00		
19	54	25.24		
9	31	52.59		
10	22	32.65		
	1	41.98		
10	20	50.67		
		70.00		
		19.33		

