KG
11366
v.438

Fundamental Stars for Zones
From July 9, 1872 to October 12, 1872
B 6

Charles W. Sever, University Bookstore, Cambridge.

1872pnae.proJ.1442R

Date July 9 1872 Observer W.A.R.
n Recorder J.F.M.

Barom. =
Att. Therm. =
Ex. Therm. =

log B =
log T =
log β =
log γ

Star.	2 H Urs Min		β Bootis		ψ Bootis		3 Serpentis		δ Bootis	
	14^h 56^m	$+66^\circ$ $26'$	14^h 57^m	$+40^\circ$ $53'$	14^h 59^m	$+29^\circ$ $26'$	15^m 9^m	$+5^\circ$ $24'$	15^h 10^m	$+33^\circ$ $47'$
T_δ										
T_m										
T_e										
T_f										
T_g										
T_h										
Sum										
Mean										
Red. to T_m										
Sum = s										
$\frac{1}{5}(T_m - T_s)$										
T										
RA										
RA — T										
— n tang δ										
ΔT + m										
$T_m - T_\delta$										
A	1	7.9	3	27.2	0	46.0	2	20.2	0	1.8
C		57.2		22.8		40.3		19.6		0.0
Sum										
Mean										
Red. for runs										
Red. to hor. wire										
Red. to meridian										
Division error										
Sum										
Pointer	0		30		0		0		40	
App. z										
log a′										
A′ log β										
λ log γ										
log tang z										
log r										
r										
z										
φ — z = δ (O)										
δ (C)										
δ (C — O)										

Date July 9 1872 Observer T.H.R. Barom. = log B =

n Recorder J.M. Att. Therm. = log T = ______ log γ

Ex. Therm. = log β =

Star.	1 H Urs Min.		θ2 Urs Min		δ Bootis		α Coronae		
	15 13 +67	49	15 21 +72	17	15 26 +41	16	15 29 +27	8	
T_δ									
T_m									
T_e									
T_f									
T_g									
T_h									
Sum									
Mean									
Red. to T_m									
Sum = s									
$\frac{1}{5}(T_m - T_s)$									
T									
RA									
RA — T									
— n tang δ									
ΔT + m									
$T_m - T_\delta$									
A	3 24.1		1 1.7		1 21.8		3 50.0		
C	15.8		53.7		18.9		44.7		
Sum									
Mean									
Red. for runs									
Red. to hor. wire									
Red. to meridian									
Division error									
Sum									
Pointer	35		10		10		15		
App. z									
log a′									
A′ log β									
λ′ log γ									
log tang z									
log r									
r									
z									
φ — z = δ (O)									
δ (C)									
δ (C — O)									

Date Jul 9 1872 Observer W.A.R.
n Recorder A.T.M.

Barom. =
Att. Therm. =
Ex. Therm. =

log B =
log T =
log β =
log γ

Star.	12 H Draco.		ε Urs Min		XX 19 H Camel		a Herculis		π Herculis	
	15 45 +62	59	16 59 +82	14			17 9 +14	32	17 11 +36	57
T_δ										
T_m										
T_e										
T_f										
T_g										
T_h										
Sum										
Mean										
Red. to T_m										
Sum = s										
$\frac{1}{5}(T_m - T_s)$										
T										
RA										
RA — T										
— n tang δ										
ΔT + m										
$T_m - T_\delta$										
A	3 30.8		3 54.2		3 36.8		0 9.2		0 33.9	
C	22.8		43.0		24.2		9.2		29.2	
Sum										
Mean										
Red. for runs										
Red. to hor. wire										
Red. to meridian										
Division error										
Sum										
Pointer	25		10		30		55		30	
App. z										
log a′										
A′ log β										
λ′ log γ										
log tang z										
log r										
r										
z										
φ — z = δ (O)										
δ (C)										
δ (C — O)										

Date July 9 1872 Observer T.W.R.

n Recorder J.F.M.

Barom. =
Att. Therm. =
Ex. Therm. =

log B =
log T =
log β =

log γ

Star.	Gr. 2437 xx	Gr. 966 xx	β Draco
			17 28 +52 24
T_δ			
T_m			
T_e			
T_f			
T_g			
T_h			
Sum			
Mean			
Red. to T_m			
Sum = s			
$\frac{1}{5}(T_m - T_s)$			
T			
RA			
RA — T			
— n tang δ			
ΔT + m			
$T_m - T_\delta$			
A	2 30,0	1 20,7	4 18,2
C	41.0	10,9	11,8
Sum			
Mean			
Red. for runs			
Red. to hor. wire			
Red. to meridian			
Division error			
Sum			
Pointer	30	25	0
App. z			
log a′			
A′ log β			
λ′ log γ			
log tang z			
log r			
r			
z			
φ — z = δ (O)			
δ (C)			
δ (C — O)			

Date Aug 11 1872 Observer W.A.R.

n Recorder J.H.M.

Barom. =

Att. Therm. =

Ex. Therm. =

log B =

log T =

log β =

log γ

Star.	Gr. 2164		β Urs Min		2 H Urs Min		β Bootis		ψ Bootis	
	14 48 +59	48	14 51 +74	40	14 56 +66	26	14 57 +40	53	14 59 +27	26
T_δ										
T_m										
T_e										
T_f										
T_g										
T_h										
Sum										
Mean										
Red. to T_m										
Sum = s										
$\frac{1}{5}(T_m - T_s)$										
T										
RA										
RA — T										
— n tang δ										
ΔT + m										
$T_m - T_\delta$										
A	4	13.8	2	37.5	1	37.1	8	0.8	0	42.1
C		8.2		29.0		28.1		56.0		38.7
Sum										
Mean										
Red. for runs										
Red. to hor. wire										
Red. to meridian										
Division error										
Sum										
Pointer	35		45		0		30		0	
App. z										
log a′										
A′ log β										
λ log γ										
log tang z										
log r										
r										
z										
φ — z = δ (O)										
δ (C)										
δ (C — O)										

Date Aug 11 1872 Observer W. A. R.

n Recorder J. F. M.

Barom. =

Att. Therm. =

Ex. Therm. =

log B =

log T =

log β =

log γ

Star.	3 Serpentis		δ Bootis		γ₂ Urs Min.		ι, Bootis		a Coronae	
	15 9 +5	24	15 10 +33	47	15 21 +72	17	15	26 +41 16	15 29 +27	8
T_δ										
T_m										
T_e										
T_f										
T_g										
T_h										
Sum										
Mean										
Red. to T_m										
Sum = s										
$\frac{1}{5}(T_m - T_s)$										
T										
RA										
RA — T										
— n tang δ										
ΔT + m										
$T_m - T_\delta$										
A	2 17.7		4 33.0		AR ong.	1 21.4			3 08.2	
C	17.5		29.7			16.9			48.3	
Sum										
Mean										
Red. for runs										
Red. to hor. wire										
Red. to meridian										
Division error										
Sum										
Pointer	0		35			10			15	
App. z										
log a′										
A′ log β										
λ′ log γ										
log tang z										
log r										
r										
z										
φ — z = δ (O)										
δ (C)										
δ (C — O)										

Date July 11 1872 Observer W.R.

n Recorder J. P. M.

Barom. =

Att. Therm. =

Ex. Therm. =

log B =

log T =

log β =

log γ

Star.	φ Bootis		12 H Draco.		ε Coronae		θ Draco.		ε Herculis	
	15 33 +40	46	15 45 +62	59	15 32 +27	14	16 0 +58	54	16 56 +31	7
T_δ										
T_m										
T_e										
T_f										
T_g										
T_h										
Sum										
Mean										
Red. to T_m										
Sum = s										
$\frac{1}{5}(T_m - T_s)$										
T										
RA										
RA — T										
— n tang δ										
ΔT + m										
$T_m - T_\delta$										
A	1 31.4		3 25.1		2 38.2		3 34.9		0 43.5	
C	26.3		16.8		35.0		27.1		38.9	
Sum										
Mean										
Red. for runs										
Red. to hor. wire										
Red. to meridian										
Division error										
Sum										
Pointer	40		25		10		80		20	
App. z										
log a′										
A′ log β										
λ′ log γ										
log tang z										
log r										
r										
z										
φ — z = δ (O)										
δ (C)										
δ (C — O)										

Date July 11 1872 Observer W. A. R.

n Recorder J. K. M.

Barom. =
Att. Therm. =
Ex. Therm. =

log B =
log T =
log β =

log γ

Star.	ε Urs Min		α Herculis		π Herculis	Gr. 2407 xx	Gr. 966 xx	β Draco	
	16 59 +82	14	17 9 +14	32	17 11 +36	57		17 28 +52	24
T_δ									
T_m									
T_e									
T_f									
T_g									
T_h									
Sum									
Mean									
Red. to T_m									
Sum = s									
$\frac{1}{s}(T_m - T_s)$									
T									
RA									
RA — T									
— n tang δ									
ΔT + m									
$T_m - T_\delta$									
A	4 48		0 11.7		0 33.5	2 57.8	1 14.8	4 16.3	
C	52.9		11.5		27.9	47.9	2.8	8.9	
Sum									
Mean									
Red. for runs									
Red. to hor. wire									
Red. to meridian									
Division error									
Sum									
Pointer	10		55		30	30	25	0	
App. z									
log a′									
A′ log β									
λ log γ									
log tang z									
log r									
r									
z									
φ — z = δ (O)									
δ (C)									
δ (C — O)									

Date July 14 1872 Observer W.A.R.

n Recorder J.F.M.

Barom. =

Att. Therm. =

Ex. Therm. =

log B =

log T =

log β =

log γ

Star.	5 Serpentis	δ Bootis		1 H Urs Min		ζ Urs Min		ψ Bootis	a Coronae
	15 9 +5	24 15 10	+33 47	15 13 +67	49	15 21 +72	17	15 26 +41	16 15 29 +27 8
T_δ									
T_m									
T_e									
T_f									
T_g									
T_h									
Sum									
Mean									
Red. to T_m									
Sum = s									
$\frac{1}{s}(T_m - T_s)$									
T									
RA									
RA — T									
— n tang δ									
ΔT + m									
$T_m - T_\delta$									
A	A.R. only.	4 33.6		8 11.7		20 50.5		1 57.5	3 37.8
C		29.5		1.9		40.3		52.7	31.8
Sum									
Mean									
Red. for runs									
Red. to hor. wire									
Red. to meridian									
Division error									
Sum									
Pointer		35		35		10		10	15
App. z									
log a′									
A′ log β									
λ log γ									
log tang z									
log r									
r									
z									
ϕ — z = δ (O)									
δ (C)									
δ (C — O)									

Date July 14 1872 Observer Y. & R.
n Recorder J. R. M.

Barom. =
Att. Therm. =
Ex. Therm. =

log B =
log T =
log β =

log γ

Star.	ρ Bootis	β Serpentis	γ Serpentis	ε Coronae	θ Draco
	15 33 +40 46	15 40 +15 49	15 51 +16 4	15 52 +27 14	16 0 +58 54
T_δ					
T_m					
T_e					
T_f					
T_g					
T_h					
Sum					
Mean					
Red. to T_m					
Sum = s					
$\frac{1}{5}(T_m - T_s)$					
T					
RA					
RA — T					
— n tang δ					
ΔT + m					
$T_m - T_\delta$					
A	1 34.1	2 58.7	2 39.0	2 41.0	3 43.5
C	30.2	57.9	87.2	36.1	34.9
Sum					
Mean					
Red. for runs					
Red. to hor. wire					
Red. to meridian					
Division error					
Sum					
Pointer	40	35	20	10	30
App. z					
log a′					
A′ log β					
λ′ log γ					
log tang z					
log r					
r					
z					
φ — z = δ (O)					
δ (C)					
δ (C — O)					

Date Jug 14 1872 Observer Y. A. R. Barom. = log B =

n Recorder J. F. M. Att. Therm. = log T = log γ

Ex. Therm. = log β =

Star.	ε Urs Min		Gr. 2415	a Herculis					
	16 39 +82	14	17 4 +40	41 17 9	+14 32				
T_δ									
T_m									
T_e									
T_f									
T_g									
T_h									
Sum									
Mean									
Red. to T_m									
Sum = s									
$\frac{1}{s}(T_m - T_s)$									
T									
RA									
RA — T									
— n tang δ									
ΔT + m									
$T_m - T_\delta$									
A	3	44.1	1 51.1	0 30					
C		33.0	46.7	38					
Sum									
Mean									
Red. for runs									
Red. to hor. wire									
Red. to meridian									
Division error									
Sum									
Pointer	10		45	55					
App. z									
log a′									
A′ log β									
λ′ log γ									
log tang z									
log r									
r									
z									
φ — z = δ (O)									
δ (C)									
δ (C — O)									

Date July 16 1872 Observer W. A. R.

n Recorder J. F. W.

Barom. =

Att. Therm. =

Ex. Therm. =

log B =

log T =

log β =

log γ

Star.	Gr. 750 XX		θ Draco		φ Herculis		Gr 2320 X X	
			16 0 +58	54	16 5 +45	16		
T_δ								
T_m								
T_e								
T_f								
T_g								
T_h								
Sum								
Mean								
Red. to T_m								
Sum = s								
$\frac{1}{s}(T_m - T_s)$								
T								
RA								
RA — T								
— n tang δ								
ΔT + m								
$T_m - T_\delta$								
A	1 13.8		3 38.2		1 38.3		4 15.2	
C	4.8		32.4		34.2		6.8	
Sum								
Mean								
Red. for runs								
Red. to hor. wire								
Red. to meridian								
Division error								
Sum								
Pointer	40		30		10		15	
App. z								
log a′								
A′ log β								
λ′ log γ								
log tang z								
log r								
r								
z								
φ — z = δ (O)								
δ (C)								
δ (C — O)								

Date Jul 16 1872 Observer T. G. R.

n Recorder J. M.

Barom. =
Att. Therm. =
Ex. Therm. =

log B =
log T =
log β =

log γ

Star.	Gr. 2343		η_2 Draco.		κ Ophiuchi		δ Urs Min		Gr 2437 xx
	16 22 +55	29	16 22 +61	48	16 52 +9	34	16 59 +82	14	
T_δ									
T_m									
T_e									
T_f									
T_g									
T_h									
Sum									
Mean									
Red. to T_m									
Sum = s									
$\frac{1}{s}(T_m - T_s)$									
T									
RA									
RA — T									
— n tang δ									
ΔT + m									
$T_m - T_\delta$									
A	8 14.4		4 26.8		2 44.2		3 31.1		~~30~~ 2 44.0
C	7.2		18.9		44.1		53.1		35.1
Sum									79.1
Mean									2 39.55
Red. for runs									
Red. to hor. wire									
Red. to meridian									
Division error									
Sum									
Pointer	55		35		50		10		30
App. z									
log a′									
A′ log β									
λ log γ									
log tang z									
log r									
r									
z									
φ — z = δ (O)									
δ (C)									
δ (C — O)									

Date July 16 1872 Observer W.A.R.
n Recorder J.F.M.

Barom. =
Att. Therm. =
Ex. Therm. =

log B =
log T =
log β =

log γ

Star.	XX Jn. 966		β Draco		a Ophiuchi		D, Draco	
			17 28 +52	24	17 29	+12 39	17 30 +55	16
T_δ					17	28 58	17 29	41
T_m					29 1.8	28 45.7	29 39.6	29 29.6
T_e					2.9	11 46.6	41.2	16 30.5
T_f					3.9	10 47.4	43.0	18 31.8
T_g					4.9	10 19.7	44.9 (46.6)	19 32.6
T_h					5.9	10 28 46.57	48.4	17 1.8 .45
Sum					7.0	11	50.4	20 29 31.12
Mean					8.1	11	52.2	18
Red. to T_m					9.1	10	53.9	17
Sum = s					10.2	11	~~55.7~~	42 0.2
$\frac{1}{5}(T_m - T_s)$					52.8		~~57.4~~	29 46.68
T					29 5.87		~~59.3~~	
RA								
RA — T								
— n tang δ								
ΔT + m								
$T_m - T_\delta$								
A	1 15.2		4 14.2		3 5.8		1 31.8	
C	5.0		8.8		5.9		25.0	
Sum					17		56.8	
Mean					3 5.85?		1 28.40	
Red. for runs								
Red. to hor. wire								
Red. to meridian								
Division error								
Sum								
Pointer	25		0		45		10	
App. z								
log a′								
A′ log β								
λ log γ								
log tang z								
log r								
r								
z								
φ — z = δ (O)								
δ (C)								
δ (C — O)								

Date Jul 16 1872 Observer W. A. R.
n Recorder J. T. M.

Barom. =
Att. Therm. =
Ex. Therm. =

log B =
log T =
log β =
log γ

Star.	ν_2 Draco		ι Herculis		10 Draco	
	17 30 +55 16		17 36 +46 4		17 38 +68 49	
T_δ	17 29	45	17 35	50	17 37	45
T_m	29 55.7	30 30.4	35 52.1	35 25.5	37 39.2	36 39.9
T_e	57.4	31.7	53.6	26.9	42.1	42.1
T_f	59.3	33.0	55.1	28.4	45.0	43.7
T_g		5.1	56.6	208	47.8	5.7
T_h		30 31.70	58.2	35 26.93	50.7	36 41.90
Sum			59.6		53.2	
Mean			1.1		56.3	
Red. to T_m			2.5		59.3	
Sum = s			4.1		52.1	
$\frac{1}{5}(T_m - T_s)$			522.9		455.7	
T			35 58.10		37 50.64	
RA						
RA — T						
— n tang δ						
ΔT + m						
$T_m - T_\delta$						
A	1 31.8		3 30.0		4 28.9	
C	25.0		24.0 ~~27.0~~		21.1	
Sum	568		540		100	
Mean	1 28.40		3 27.00		4 25.00	
Red. for runs						
Red. to hor. wire						
Red. to meridian						
Division error						
Sum						
Pointer	19		20		35	
App. z						
log a′						
A′ log β						
λ log γ						
log tang z						
log r						
r						
z						
ϕ — z = δ (O)						
δ (C)						
δ (C — O)						

Date July 20 1872 Observer Y.A.R.

n Recorder

Barom. =

Att. Therm. =

Ex. Therm. =

log B =

log T =

log β =

log γ

Star.	July 20 ε Urs Min ~~α Herculis~~ ~~λ Cygni~~	July 20 — c α Herculis ~~[illegible]~~	β Draco	× × 44 Oph.	α Oph.	ω Draco	μ Herculis	ψ Draco
	16 59 +82 14	17 9 +14 32	17 28 +52 24		17 29 +12 39	17 38 +68 49	17 42 +27 48	17 44 +72 13
T_δ	16 57 50.4	17 08 42.1	17 27 19.1	17 18 26.1	17 28 53.3	17 37 16.4	17 41 19.3	17 43 41.6
T_m	6.2	44.3	22.4	28.3	55.3	22.2	21.7	48.3
T_e	21.3	46.3	26.0	30.5	57.4	27.6	24.1	55.7
T_f	51.8	50.7	32.7	35.0	1.6	39.0	28.7	8.7
T_g	7.5	53.0	36.1	37.3	3.7	44.7	31.1	15.3
T_h	22.4	55.0	38.5	39.6	5.8	50.5	33.3	21.9
Sum	37.6	57.0	42.7	41.9	8.0	56.1	35.6	28.8
Mean	53.1	59.1	46.0	44.1	10.2	1.9	38.0	35.8
Red. to T_m	23.3	3.4	52.8	48.6	14.4	13.2	42.5	49.1
Sum = s	38.9	5.7	56.2	50.8	16.5	18.8	45.0	15.7
$\frac{1}{5}(T_m - T_s)$	54.2	4.7	57.8	53.1	18.6	24.6	47.3	2.6
T	16 59 22.46 .435	8 54.94 .945	27 39.39 .391	18 39.57 .573	29 5.89 .891	50.50 .455	41 33.33 .327	22.08 .082
RA	22.36 16.10	54.92 50.44	39.37 34.60	23.15 35.34	5.87 1.46	37 50.54 45.19	33.31 28.83	44 22.08 16.51
RA — T	−6.26	−4.48	−4.69	−4.21	−4.41	−5.32	−4.48	−5.42
— n tang δ								
ΔT + m		Line Stars			~~Do~~	Pole stars.		

	Line Stars				Pole stars.
	s tang δ n tang δ −(ΔT+m)				n −.31
$T_m - T_\delta$	0 = +4.48 +.26 −.08 +	4.40	+5	25	0 = +6.26 +7.34 −.26 − 2.28 +3.88
A	4.21 − .45 +.14	.34	+1	1	+5.32 +2.58 −.39 −.40 4.52
C	4.69 +1.30 −.40	29	+6	36	+5.42 +3.12 −.34 −.87 4.45
Sum	4.41 + .22 −.07	34	+1	1	+9.24 +16.86 −.29 −5.23 4.01
Mean	4.48 + .53 −.16	32	+3	9	−1.93 −20.42 −.30 +6.42 4.49
Red. for runs	4.69 +1.26 −.39	30	+5	25	4.29
Red. to hor. wire	4.19 − .59 +.18	37	+2	4	
Red. to meridian	4.38 − .15 +.05	43	+8	64	
Division error	4.62 + .80 −.25	37	+2	4	
Sum	4.53 + .65 −.20	33	+2	4	
Pointer	4.20 − .50 +.16	36	+1	1	
App. z		4.35 ±.008		.0174	ΔdT = −.13
				00174	
log a′				±.028	
	m = 43 + 28 = +.71				
A′ log β	dT + m = −4.35				b = +.39
λ log γ	dT = +5.06				m = .52 + 28 = ~~+.79~~ .80
log tang z					dT + m = −4.35
log r					dT = 5.18
r					
z					
φ — z = δ (O)					
δ (C)					
δ (C — O)					

Date July 20 1872 Observer W.A.R.

n Recorder

Barom. =
Att. Therm. =
Ex. Therm. =

log B =
log T =
log β =

log γ

Star.	ζ Draco.	ϑ₁ Sagitt.	δ Urs Min.	λ Aquilae	α Lyrae	51 Ceph.	β Lyrae	σ Sagitt.	50 Draco.
	17 54 +51 30		18 13 +86 36		18 33 +38 40		18 45 +33 13	47	50
T_δ	17 53 25.2	17 57 27.5	18 12 54.0	18 28 8.5	18 32 27.3	18 36 18.3	18 44 13.1	18 46 12.5	18 49 23.0
T_m	28.4	29.7	11.8	10.6	21 29.8	19.5	15.5	14.7	27.4
T_e	31.6	32.1	27.2	12.6	20 32.5	39.7	18.0	17.0	31.2
T_f	38.4	37.0	45.0	16.8	42 37.8	3.0	22.8	21.7	35.1
T_g	41.8	38.2	0.7	18.9	40.5	24.3	25.3	24.0	38.3
T_h	45.1	41.7	20.1	21.0	42.9	43.6	28.0	26.2	43.4
Sum	48.3	44.1	38.9	23.1	45.7	5.4	30.0	28.6	47.4
Mean	51.5	46.5	54.3	25.2	48.4	26.1	32.8	30.9	51.5
Red. to T_m	58.1	57.4	11.7	29.3	53.3	48.8	82.8	30.5	55.5
Sum = s	1.5	53.7		31.4	56.3		40.1	37.8	
$\frac{1}{5}(T_m - T_s)$	4.8	56.1		30.5	58.9		42.6	40.0	
T	53 44.97 .973	41.73 .7275	14.264 .633	28 20.99 .991	32 43.04 .077	23.20 .189	45 27.85 .855	47 26.26 .263	50 35.31 .311
RA	44.95 40.26	57 41.71 37.52	2.38 53.14	20.57 16.59	43.02 38.40	39 23.53 25.46	27.83 23.30	26.24 22.04	35.25 33.99
RA − T	−4.69	−4.19	−9.24	4.38	−4.62	+1.93	−4.53	−4.20	5.46
− n tang δ									
ΔT + m									

$T_m - T_\delta$									
A						2 49.0		1 49.7	
C						37.2		38.6	
Sum								88.3	
Mean								11 44.15	
Red. for runs									
Red. to hor. wire									
Red. to meridian									
Division error									
Sum									
Pointer						40		10	
App. z									
log a′									
A′ log β									
λ′ log γ									
log tang z									
log r									
r									
z									
ϕ − z = δ (O)									
δ (C)									
δ (C − O)									

Date July 21 1872 Observer J. W. R.

n

Recorder

b = +40

Barom. =

Att. Therm. =

Ex. Therm. =

log B =

log T =

log β =

log γ

Star.	n = −31 α. Cygni.							
	20 53 +40	41						
T_δ	20 52 25.3							
T_m	26.6	1.8						
T_e	28.0	1.4 1.3						
T_f	29.3	1.4						
T_g	− 30.7	1.4						
T_h	+ 32.1	1.7						
Sum	33.3	1.3						
Mean	34.6	1.3						
Red. to T_m	35.9							
Sum = s	275.8							
$\frac{1}{5}(T_m - T_s)$								
T	× 30.62	644						
RA	30.60 26.24							
RA — T	− 4.36							
— n tang δ	+ .41							
ΔT + m	− 3.95							
	m = 82 dT = −4.77		b = +.40					
$T_m - T_\delta$	4 dT = −.14		m = 54 + 28	82				
A								
C								
Sum								
Mean								
Red. for runs								
Red. to hor. wire								
Red. to meridian								
Division error								
Sum								
Pointer								
App. z								
log a′								
A′ log β								
λ′ log γ								
log tang z								
log r								
r								
z								
φ — z = δ (O)								
δ (C)								
δ (C — O)								

Date July 22 1872 Observer N.A.R.
n Recorder A. N. M.

Barom. =
Att. Therm. =
Ex. Therm. =

log B =
log T =
log β =

log γ

Star.	ρ Herculis	ε Ophiuchi	ω Herculis	β Herculis	Gr. 2373
	16 5 +45 16	16 12 −4 23	16 20 +14 19	16 25 +21 46	16 36 +77 42
T_δ					
T_m					
T_e					
T_f					
T_g					
T_h					
Sum					
Mean					
Red. to T_m					
Sum = s					
$\frac{1}{5}(T_m - T_s)$					
T					
RA					
RA — T					
— n tang δ					
ΔT + m					
$T_m - T_\delta$					
A	1 27.0	4 40.8	1 52.2	1 14.8	1 30.9
C	22.2	43.1	58.2	12.1	20.2
Sum					
Mean					
Red. for runs					
Red. to hor. wire					
Red. to meridian					
Division error					
Sum					
Pointer	10	45	5	40	40
App. z					
log a′					
A′ log β					
λ log γ					
log tang z					
log r					
r					
z					
φ — z = δ (O)					
δ (C)					
δ (C — O)					

Date Aug 22 1872 Observer W.R

n Recorder J. F. M.

Barom. =
Att. Therm. =
Ex. Therm. =

log B =
log T =
log β =

log γ

Star.	η Herculis	κ Ophiuchi	ε Urs. Min	α ~~Ophiuchi~~ Herculis
	16 39 +39 10	16 52 +9 34	16 59 +82 14	17 9 +14 32
T_δ				
T_m				
T_e				
T_f				
T_g				
T_h				
Sum				
Mean				
Red. to T_m				
Sum = s				
$\frac{1}{5}(T_m - T_s)$				
T				
RA				
RA — T				
— n tang δ				
ΔT + m				
$T_m - T_\delta$				
A	2 45.0	2 24.8	3 47.0	
C	40.7	24.0	37.2	
Sum				
Mean				
Red. for runs				
Red. to hor. wire				
Red. to meridian				
Division error				
Sum				
Pointer	15	50	10	
App. z				
log a′				
A′ log β				
λ log γ				
log tang z				
log r				
r				
z				
φ — z = δ (O)				
δ (C)				
δ (C — O)				

Date July 22 1872　Observer Y. A. R.　Barom. =　log B =

Att. Therm. =　log T = ________　log γ

n　Recorder J. F. M.　Ex. Therm. =　log β =

Star.	μ Herculis 17 42 +27 48	ψ Draconis 17 44 +72 13	α Lyrae 18 33 +38 40	δ Urs Min 18 13 +86 36	× × Il. 51 Cephei 18 39
T_δ					
T_m					
T_e					
T_f					
T_g					
T_h					
Sum					
Mean					
Red. to T_m					
Sum = s					
$\frac{1}{s}(T_m - T_s)$					
T					
RA					
RA — T					
— n tang δ					
ΔT + m					
$T_m - T_\delta$					
A	AR	A.R.	A.R.	AR	AR.
C					
Sum					
Mean					
Red. for runs					
Red. to hor. wire					
Red. to meridian					
Division error					
Sum					
Pointer					
App. z					
log a′					
A′ log β					
λ log γ					
log tang z					
log r					
r					
z					
φ — z = δ (O)					
δ (C)					
δ (C — O)					

Date July 22 1872 Observer W. A. R.

Barom. =
Att. Therm. =
Ex. Therm. =

log B =
log T =
log β =

log γ

n

Recorder

Line stars for longitude (Trans atlantic)

Star.	τ Herculis; ~~η Herculis~~	κ Ophiuchi	ι Herculis	ε Urs Min	α Herculis	44 Oph.	ω Draco
	16 16+46 37 53.6	16 52 +9 34	16	16 59 +82 14	17 9 +14 32		17 38 +68 49
T_δ	16 15 55.2	16 51 29.8	56 43.9	16 58 51.6	17 08 50.2	17 18 25.7	17 37 15.6
T_m	56.6	31.8	46.4	58.9	51.3	27.5	21.3 ~~27~~
T_e	58.0	33.5	48.9	6.3	52.4	30.1	27.0
T_f	59.6	38.2	53.8	14.2	53.4	34.7	38.7
T_g	1.1	40.3	56.3	21.8	54.5	37.0	44.1
T_h	2.6	42.4	58.7	29.4	55.5	39.7	45.8
Sum	4.1	44.5	1.2	37.4	56.6	41.4	55.6
Mean	5.6	46.5	3.7	45.1	57.7	43.7	1.3
Red. to T_m		50.7	8.7	52.3	58.8	48.3	12.7
Sum = s		52.8	11.1			50.4	18.2
$\frac{1}{5}(T_m - T_s)$		54.8	13.6			52.8	23.9
T	15 59.600 600	51 42 43. ~~427~~ 336	56 58.74 .755	59 21.89 .8898	54.49 .489	18 39.24 .245	37 49.84 836
RA	59.58 55.22	42.41 38.30	58.72 54.62	21.79 15.83	54.47 50.43	39.21 35.26	49.80 45.12
RA — T T − RA	+4.36	+4.11	+4.10	+5.96	+4.04	+3.85	+4.68
— n tang δ							
ΔT + m							

Line stars

n = −.276

$T_m - T_\delta$ 16 15 0 = +4.36 +1.06 −.29 +4.07 65 36 25
A 16 51 +4.11 +.16 −.04 4.07 65 36 25
C 16 56 +4.10 +.66 −.18 4.04 (3.92) 46 81 36
Sum 17 08 +4.04 +.26 −.07 3.97 45 16 36
Mean 17 18 +3.85 −.45 +.12 3.97 45 16 25
Red. for runs 17 41 +4.07 +.53 −.15 3.92 9 0 81 0
Red. to hor. wire 17 53 +4.39 +1.26 −.34 4.05 43 16 9
Red. to meridian 18 32 +4.26 +.80 −.22 4.04 32 9 4
Division error 18 45 +4.16 +.65 −.18 4.08 76 49 36
Sum 18 47 0 = +3.55 −.50 +.14 3.99 23 4 9
Pointer +4.01 ±.009 .0205
App. z 17 36 0 = +4.14 +.44 .00205
±.030

Pole stars

n ntang δ −(ΔT+m)

0 = +5.96 +7.34 −.26 −2.03 +3.83
+4.68 +2.58 −.26 −.71 3.97
+4.87 +3.12 −.28 −.86 4.01
+9.06 +16.86 −.30 −4.65 3.41
−1.76 −20.72 −.28 +5.73 3.97
−.276 +3.84

log a' b = +.38 (5)
A' log β m = b sec φ − n tang φ   dT+m = −4.07   b = −.39
λ log γ = 1.36 × .38 + .90 × .276 =   m = + .77   m = .51 + .25 = .76
log tang z = .51 + .26 = +.77   dT = +4.78
4 dT = −.13
log r
r
z
φ — z = δ (O)
δ (C)
δ (C — O)

Date July 22 1872 Observer T. A. R.

n

Recorder

Barom. =
Att. Therm. =
Ex. Therm. =

log B =
log T =
log β =

log γ

Star.	ω Herculis	ψ Draco	γ Draco.	δ Urs Min	α Lyrae	51 Ceph.	β Lyrae	σ Sagitt. ~~50 Draco~~
	17 42 +27 48	17 44 +72 13	+51 30	1813 +86 36	1833 +38 40		1845 +33 13	
T_δ	17 41 18.9	17 43 40.9	17 53 24.8	18 11 33.5	18 32 26.9	18 35 7.4	18 45 12.6	18 47 12.2
T_m	21.3	47.7	28.2	7.7	29.5	50.3	15.2	14.3
T_e	23.6	54.2	31.4	42.4	32.1	33.1	17.7	16.7
T_f	28.2	7.8	38.0	52.7	37.3	57.8	22.5	21.4
T_g	30.6	14.6	41.3	26.3	40.0	42.7	25.0	23.6
T_h	32.9	21.4	44.6	2.0	42.6	22.4	27.5	26.1
Sum	35.3	28.0	48.0	36.7	41.7	6.9	29.9	28.3
Mean	37.5	35.0	57.3	12.1	48.2	49.8	32.3	30.5
Red. to T_m	42.2	48.4	57.7	20.7	53.2	15.1	34.3	35.1
Sum = s	44.6	53.0	1.2	56.7	55.8	57.3	35.8	37.4
$\frac{1}{6}(T_m - T_s)$	46.9	2.0	4.5	81.2	58.5	40.8	42.3	39.6
T	41 32.91 .909	44 21.45	51 53 49.64 .636	14 2.000	82 42.60 .655	37 23.964	40 27.46 .464	25.53 .927
RA	32.89 28.82	21.40 16.53	44.62 40.28	1.74 52.68	42.65 38.39	24.29 26.05	27.46 23.30	47 25.92 22.06
RA − T	+4.07	+4.87	+4.39	+1.06	+4.26	−1.76	+4.16	+3.85
− n tang δ								
ΔT + m								
$T_m - T_\delta$								
A								
C								
Sum								
Mean								
Red. for runs								
Red. to hor. wire								
Red. to meridian								
Division error								
Sum								
Pointer								
App. z								
log a′								
A′ log β								
λ′ log γ								
log tang z								
log r								
r								
z								
φ − z = δ (O)								
δ (C)								
δ (C − O)								

Date Aug 23 1872 Observer N.A.R.
n
Recorder

Barom. =
Att. Therm. =
Ex. Therm. =

log B =
log T =
log β =
log γ

Star.	Polaris (233)	γ₂ Urs Min	α Scorpii	η Draconis	d Herculi	d Herculis d Draconis	ε Urs Mi
		15ʰ 21ᵐ +72° 17′		16ʰ 22ᵐ +61° 48′			16ʰ 59ᵐ +82° 14′
T_δ	—	15 20 50.2	16 21 25.4	16 22 13.3	16 55 14.8	16 56 43.7	16 58 51.4
T_m	—	53.2	27.8	15.3	17.1	46.1	58.4
T_e	13 11 58.6	16.6	30.0	17.8	19.6	48.8	5.8
T_f	42.0	0.2	34.6	19.7	24.4	53.6	13.8
T_g	23.4	3.5	37.0	22.1	26.8	56.2	21.8
T_h	6.4	6.6	35.3	24.3	29.2	58.6	29.4
Sum	48.8	10.1	41.5	26.3	31.6	1.2	36.7
Mean	40.9	13.5	43.5	28.5	34.0	3.5	44.7
Red. to T_m	7.8	17.0	48.3	30.7	38.7	8.5	52.3
Sum = s	31.8		50.6	22.000	41.2	11.0	9
$\frac{1}{5}(T_m - T_s)$		3.433 3.38	52.9	21.57 17.74	48.7	13.4	
T	11 58.6	21 3.38	21 39.00	22 21.97	56 29.19 1.191	56 58.00	21 59.589
RA	59.2 12 6.3	58.90 59.	35.18 35.55	17.81 17.74	29.16 25.24	58.58 54.60	21.49 15.71
RA — T T-K H.	− 7.1	+ 4.48	+ 3.65	+ 4.23 (4.16)	+ 3.92	+ 8.98	3.78
— n tang δ							
ΔT + m							

n = −.27

$T_m - T_\delta$	16 21	0 = + 3.65 − .49 + .13	3.78
A	16 22	+ 4.22 + 1.86 − .50	72 Corr = −.12
C	16 56	+ 3.98 + .67 − .18	80
Sum	16 57	+ 3.92 + .61 + .16	.76
Mean	15.6		3.77
Red. for runs	16 39	0 = + 3.94 + .67	
Red. to hor. wire			
Red. to meridian		b = + .38	
Division error		m = 1.35 × .38 + .27 + .91	
Sum		= .52 + .25 = + .76	
Pointer		dT + m = − 3.77	
App. z		dT − 4.53	
		4dT = + .25	
log a′			
A′ log β			
λ′ log γ			
log tang z			
log r			
r			
z			
φ — z = δ (O)			
δ (C)			
δ (C — O)			

n
0 = − 7.10 − 41.80 − .26 + 11.30 + 4.20
0 = + 4.48 + 3.13 (22) − .84 + 3.60
0 = 5.78 + 7.34 − .28 − 1.91 3.87
3.89

b = .39
m = .51 + .24 = .75

Date July 24 1872 Observer W. A. R.

n Recorder S. T. M.

Barom. =

Att. Therm. =

Ex. Therm. =

log B =

log T =

log β =

log γ

Star.	η Draconis		β Herculis		A Draconis		Gr. 2377		κ Ophiuchi	
	16^h 22^m +61	48	16^h 25^m +21	46	16^h 28^m +69	2	16^h 43^m +57	0	16^h 52^m +9	34
T_δ										
T_m										
T_e										
T_f										
T_g										
T_h										
Sum										
Mean										
Red. to T_m										
Sum = s										
$\frac{1}{5}(T_m - T_s)$										
T										
RA										
RA — T										
— n tang δ										
ΔT + m										
$T_m - T_\delta$										
A	3 2.3		1 20.0		0 28.9		1 23.1		2 44.7	
C	55.9		15.7		21.1		18.1		44.1	
Sum	118.2						36.2		8	
Mean	2 59.10						1 18.10		2 44.40	
Red. for runs										
Red. to hor. wire										
Red. to meridian										
Division error										
Sum										
Pointer	35		40		25		45		50	
App. z										
log a′										
A′ log β										
λ′ log γ										
log tang z										
log r										
r										
z										
φ — z = δ (O)										
δ (C)										
δ (C — O)										

Date Aug 27/1872 Observer W A R.

n Recorder J. F. M.

Barom. =

Att. Therm. =

Ex. Therm. =

log B =

log T =

log β =

log γ

Star.	δ Urs Min.		Gr. 966		β Draconis		ι Herculis	
	16 59	+82 14	1ᵉ		17 28	+52 24	17 36	+46 4
T_δ								
T_m								
T_e								
T_f								
T_g								
T_h								
Sum								
Mean								
Red. to T_m								
Sum = s								
$\frac{1}{s}(T_m - T_s)$								
T								
RA								
RA — T								
— n tang δ								
ΔT + m								
$T_m - T_\delta$								
A	3 49.0		1 49.0		4 9.5	3 14.3	3 28.9	2 38.9
C	88.9		38.5		2.9	8.9	23.1	84.0
Sum								
Mean								
Red. for runs								
Red. to hor. wire								
Red. to meridian								
Division error								
Sum								
Pointer	20		25		0		20	
App. z								
log a′								
A′ log β								
λ′ log γ								
log tang z								
log r								
r								
z								
φ — z = δ (O)								
δ (C)								
δ (C — O)								

Date Aug 24 1872 Observer W.A.R.

n Recorder J. F. M.

Barom. =

Att. Therm. =

Ex. Therm. =

log B =

log T =

log β =

log γ

Star.	δ Urs min		α Lyrae		×× 51 Ceph.		β Lyrae.	
	18 13	+86 36	18 33	+38 40			18 45	+33 13
T_δ								
T_m								
T_e								
T_f								
T_g								
T_h								
Sum								
Mean								
Red. to T_m								
Sum = s								
$\frac{1}{8}(T_m - T_s)$								
T								
RA								
RA — T								
— n tang δ								
ΔT + m								
$T_m - T_\delta$								
A	H. R.		H. R.		H. R.			
C								
Sum								
Mean								
Red. for runs								
Red. to hor. wire								
Red. to meridian								
Division error								
Sum								
Pointer								
App. z								
log a′								
A′ log β								
λ log γ								
log tang z								
log r								
r								
z								
φ — z = δ (O)								
δ (C)								
δ (C — O)								

Time stars for Trans Atlantic Longitude

Date July 24 1872 Observer W A R

n

Recorder

Barom. =

Att. Therm. =

Ex. Therm. =

log B =

log T =

log β =

log γ

Star.	x x Polaris	η Bootis	α Bootis	θ Bootis	β ~~Bootis~~ Urs Min	^ β Bootis γ Urs Min	α Coronae	δ Oph.
		13 48 +19 2	14 10 +19 50	14 21 +52 26	14 51 +74 40	15 21 +72 17	15 29 +27 8	16 8 −3 22
T_δ	13 5 10.0	13 48 26.7	14 09 40.8	14 20 48.0	14 50 56.6	15 20 49.6	15 29 7.2	16 07 31.1
T_m	57.9	28.9	42.9	49.8	0.7	53.2	9.4	33.1
T_e	33.4	31.1	45.1	51.7	4.5	56.5	11.8	35.2
T_f	16.9	35.5	49.4	53.5	8.4	59.7	16.4	39.3
T_g	59.3	37.5	57.7	55.1	12.3	2.8	18.7	41.2
T_h	41.4	39.7	53.8	56.8	16.3	6.4	21.0	43.3
Sum	22.7	41.9	56.0	58.4	20.0	9.8	23.4	45.5
Mean	10.2	44.1	58.2	0.3	23.5	13.4	25.6	47.4
Red. to T_m	57.5	48.4	2.5	1.8	28.0	16.7	30.3	57.8
Sum = s		50.6	4.8				32.5	58.7
$\frac{1}{5}(T_m - T_s)$		52.8	6.9				34.9	55.8
T	11 59.700	48 39.746	9 53.827	20 55.078	51 12.355	21 3.122	21.02 018 29 21.00	7 43.400
RA	12 0.33	39.73 36.17	53.81 50.21	55.06 51.27	12.20 7.79	3.07 58.83	27.44 23.59	43.38 39.81
RA − T	7.07	3.56	3.60	3.79	4.41	4.24	3.59	21 ~~3.51~~ 47
− n tang δ	−6.74							
ΔT + m								

n = −.250

$T_m - T_\delta$	0 = +3.56 + 35 − 09	3.47	0 = −6.74 − 41.60 + .25
A	+3.60 + .36 − 09	51	+4.41 + 3.65 + .26
C	+3.79 + 1.32 − 33	46	+ 4.24 + 3.13 + .31
Sum	+3.59 + .05 − 13	46	+.273
Mean	+3.47 + 0.06 − 1	46	
Red. for runs			
Red. to hor. wire	0 = +3.60 + .52	−3.47	
Red. to meridian			
Division error			
Sum			
Pointer			
App. z			
log a′			
A′ log β			
λ log γ			
log tang z			
log r			
r			
z			
φ − z = δ (O)			
δ (C)			
δ (C − O)			

Date Jul 24 1872 Observer W.A.R. Barom. = log B =

n Recorder Att. Therm. = log T = log γ

Ex. Therm. = log β =

Star.	β Bootis 14 57 +40 53	τ Herculis 1.06 16 16 +46 37	α Scorpii −4 × ×	η Draconis 16 22 +61 48	A Draconis	ζ Oph. × ×	d Herculis × ×	ε Herculis 16 59 +82 14	β Draconis 17 28 +52 24
T_δ	14 56 56.0	16 15 41.2	16 21 25.1	16 22 13.0	16 28 8.6	16 29 59.1	16 56 –	16 58 50.6	17 27 18.3
T_m	58.8	44.1	27.4	15.7	12.4	1.3	–	58.2	21.5
T_e	1.5	47.0	29.7	17.2	15.5	3.5	–	5.8	25.0
T_f	6.9	53.1	34.3	19.5	18.2	7.6	53.4 −4	13.4	31.7
T_g	9.6	56.1	36.6	21.7	20.9	9.8	55.9 4	20.7	35.1
T_h	12.4	59.1	38.8	23.9	24.0	11.9	58.3 4	28.3	38.5
Sum	15.2	2.1	41.2	26.1	26.9	14.0	0.8 4	36.3	41.8
Mean	17.8	5.1	43.4	28.2	29.7	16.2	3.3 4	44.4	45.3
Red. to T_m	23.3	11.0	47.9	30.2	32.6	20.2	8.2 5 5 4	51.7	52.1
Sum = s	25.9	13.9	50.3			22.3	10.6 .43		55.3
$\frac{1}{5}(T_m - T_s)$	28.6	17.0	52.5			24.5	13.2		58.7
T	57 12.364	15 59.064	21 38.84	22 36 21.655	20 58.978	30 11 53.855	58.31	21 04.4	38.482
RA	12.44 8.62	59.05 05 55.~~32~~ 27	38.82 30.48	21.69 17.70	20.92 16.98	11.84 8.41	58.29 54.63	20.94 15.59	38.46 34.61
RA − T	3.82	3.73 78	3.84	(.77) 3.94	3.94	3.43	3.66	5.35	3.85
− n tang δ									
ΔT + m									

	n = −2.50	
$T_m - T_\delta$	0 = +3.82 +0.87 −22 (3.61)	0 = +3.94 1.79 −.25 Corr = −11
A	+3.78 +1.06 −.29 54	0 = +3.94 +2.61 −(19) Sp.
C	+3.34 − .49 +.12 3.46	0 = 3.35 +7.34 −28
Sum	3.43 − .18 +5 50	−.265
Mean	3.66 +.67 −17 58	
Red. for runs	3.85 +1.30 −.32 63 3.50	
Red. to hor. wire		
Red. to meridian	0 = +3.66 +.54	
Division error		
Sum		
Pointer		
App. z		
log a′		
A′ log β		
λ log γ		
log tang z		
log r		
r		
z		
φ − z = δ (O)		
δ (C)		
δ (C − O)		

Date Jul 24 1872 Observer W.A.R

n Recorder

Barom. =
Att. Therm. =
Ex. Therm. =

log B =
log T =
log β =

log γ

Star.	×× γ2 Sagittarii	δ Ursæ Min. 18h 13m +86° 36'	×× λ Aquilæ	α Lyræ 18h 33m +38° 40'	×× 51 Cephei	β Lyræ 18h 45m +33° 13'	×× θ Sagitt.
T_δ	17 57 26.5	18 12 49.7	18 28 7.6	18 32 26.4	18 37 58.2	18 45 12.3	18 47 11.7
T_m	28.9	7.9	9.5	28.9	19.8	21.6 14.8	13.9
T_e	31.2	24.5	11.7	31.5	40.0	20.2 17.1	16.2
T_f	36.1	42.9	15.9	36.8	3.5	23.5 22.0	20.9
T_g	38.5	59.8	18.1	39.4	− 25.4	21.9 24.5	23.2
T_h	40.9	17.9	20.2	42.1	45.7	20.3 27.1	25.5
Sum	43.3	34.6	22.3	44.8	7.3	21.6 29.4	27.7
Mean	45.6	51.1	24.3	47.3	28.2	20.9 31.9	30.2
Red. to T_m	50.4	2.8	28.4	52.7	49.2	21.0 36.8	34.8
Sum = s	52.8		30.6	55.3		39.3	37.0
$\frac{1}{5}(T_m - T_s)$	55.2		32.6	57.9		41.7	39.3
T	40.853	× 59.80.800	2011.109	42.100	24.144	26.991	25.491
RA	40.84 37.51	27 52.25 59.50	20.09 16.59	42.08 38.37	24.47 26.54	26.97 23.28	25.47 22.07
RA — T T − RA.	+ 3.33	+ 7.25	+ 3.50	+ 3.71	− 2.07	+ 3.69	+ 3.40
— n tang δ							
ΔT + m							

$T_m - T_\delta$	0 = +3.33 − 5.9 + 15	3.48	0 = + 7.25 + 16.86 + .22
A	3.50 − 15 + 04	3.46	− 2.07 = 20.72 − 27
C	3.71 + 80 − 20	3.51	+ 4.14 + 2.41 − 27
Sum	3.69 + 65 − 16	3.53	+ 4.18 + 3.29 − 21
Mean	3.40 − 50 + 12	3.52	.242
Red. for runs	3.51 + 24 − 06	3.45	
Red. to hor. wire	3.38 − 35 + 09	3.47	
Red. to meridian	3.48 + .05 − 01	3.47	
Division error			
Sum	0 = +3.50 + .02	3.48	
Pointer			
App. z			

25
26
31
25
19
28
22
27
27
21
253

n = −.253

log a'
A' log β
λ' log γ
log tang z
log r
r
z
φ — z = δ (O)
δ (C)
δ (C — O)

Date Jul 24 1872 Observer V.D.R. Barom. = log B =

n Recorder Att. Therm. = log T = log γ

Ex. Therm. = log β =

Star.	(60 Draco	ζ Aquilae	d Sagitt.	δ Draco 19 13 + 67° 26	τ Draco 19 18 + 73° 7	δ Aquilae 19 19 + 2° 52
T_δ	18 50 21.9	18 59 24.5	19 10 1.3	19 12 28.0	19 17 54.2	19 18 55.4
T_m	26.1	26.5	3.5	30.6	57.5	57.9
T_e	30.2	28.7	5.8	33.3	1.2	0.0
T_f	34.4	22.9	10.1	35.9	4.7	4.3
T_g	38.4	35.1	12.2	38.5	8.2	6.3
T_h	42.5	37.2	14.4	41.1	11.8	8.3
Sum	46.5	39.3	16.6	43.8	15.4	10.3
Mean	50.6	41.4	18.8	46.6	18.8	12.4
Red. to T_m	54.7	45.6	23.2	49.1	22.5	16.5
Sum = s		47.7	25.3			18.6
$\frac{1}{5}(T_m - T_s)$		49.9	27.6			20.7
T	× 38.44 367	87.164	14.136	38.544	8.256	8.291
RA	3.842	37.15 33.64	14.42 11.04	38.50 34.36	8.20 4.02	8.28 4.80
RA — T		3.51	3.38	4.14	4.18	3.48
— n tang δ						
ΔT + m						

		ΔT+m		
$T_m - T_\delta$	n. Bootis	−3.47	1	1
A	α Bootis	51	3	9
C	θ Bootis	46	2	4
Sum	α Coronae	46	2	4
Mean	δ Oph.	46	2	4
Red. for runs	τ Herculis	~~46~~51	2	4
Red. to hor. wire	α Scorpii	46	2	4
Red. to meridian	ζ Oph.	50	2	4
Division error	λ Herc.	53	5	25
Sum	β Draco.	53	5	25 ±.019
Pointer	γ2 Sagittarii	48	0	0
App. z	ι Aquilae	46	2	4
	α Lyrae	51	3	9
log a′	β Lyrae	53	5	25
A′ log β	o Sagittarii	52	4	16
λ log γ	ξ Aquilae	46	2	4
log tang z	d Sagittarii	47	1	1
log r	δ Aquilae	47	1	1
r				.0144
z		−3.48±.0051		00084
φ — z = δ (O)				
δ (C)		b = +.37		
δ (C — O)		m = +.50 + 23 = +.73		

b = +.38
m = .51 + 23 = .74

dT = −3.48
− .72
= −4.20

Time stars for Trans Atlantic Longitude

Date Aug 25 1872 Observer WAR. Barom. = log B =

Att. Therm. = log T =

n Recorder Ex. Therm. = log β = log γ

Star.	T Herculis	α Scorpii	η Draco	A Draco	κ Ophiuchi	d Herculis	ε Urs Min	α Herculis
	16 16 +46 37	××	16 22 +61 48	16 28 +69 2	16 52 +9 34	16 ××	16 59 +82 14	17 9 +14 32
T_δ	16 15 41.1	21 34.3	22 12.7	28 9.7	51 29.3	56 43.4	58 50.2	08 41.2
T_m	43.9	35.4	15.0	12.5	31.3	45.9	58.3	43.2
T_e	47.0	36.5	17.2	15.4	33.5	48.4	6.2	45.5
T_f	53.0	37.8	19.6	18.3	37.7	53.3	13.3	49.6
T_g	55.9	38.9	21.6	21.1	39.7	55.8	20.5	51.8
T_h	59.0	40.1	23.7	24.1	41.8	58.3	28.5	53.9
Sum	1.9	41.2	25.9	26.9	43.9	0.7	35.9	56.2
Mean	5.0	42.8	28.1	29.8	46.0	3.1	43.6	58.2
Red. to T_m	11.0	43.4	30.3	32.5	50.1	8.2	51.4	2.4
Sum = s	13.9				52.2	10.6		4.5
$\frac{1}{5}(T_m - T_s)$	17.0				54.8	12.9		6.8
T	589/3	3888.878	21556	21144	41800	5824.236	× 2088878	5394.936
RA	58.95 55.29	38.87 35.48	21.52 17.66 (73)	21.10 16.93	41.78 38.27	58.22 54.58	20.73 15.41	53.52 50.41
RA — T	3.74	3.39	3.86 (3.79)	4.17	3.51	3.64	3.32	3.07
— n tang δ								
ΔT + m								

		n = −.268		n	
	16 15	0 = 3.76 + 1.06 − 27	3.44	0 = 3.86 + 1.79 − 22 − 46	3.40
$T_m - T_\delta$	16 21	3.39 − 49 + .13	3.52	4.17 + 2.61 − 28 − 67	3.50
A	16 51	3.51 + 17 − 4	3.47	6.32 + 7.34 − 26 − 1.89	3.43
C	16 56	3.64 + .67 − 17	3.47	2.24 − 3.72 − 31 + .96	3.30
Sum	17 08	3.51 + .26 − 7	3.44	4.15 + 3.12 − 22 − 80	3.35
Mean	17 27	3.71 + 1.30 − 33	3.38	129	198
Red. for runs	17 28	3.49 + 22 − 06	3.43	.258	3.40
Red. to hor. wire	17 58	3.80 + 1.26 − 32	3.48		
Red. to meridian			3.45		
Division error	16 59	0 = 3.59 + .56			
Sum					b = .37
Pointer			dT + m = −3.45		
App. z			.74	b = +38 m = 51 + 23 = +.74	m = 49 + 23 = +.72
			dT = − 4.19		
log a'					
A' log β					
λ log γ					
log tang z					
log r					
r					
z					
φ — z = δ (O)					
δ (C)					
δ (C — O)					

Date
Observer
Barom. =
log B =
Att. Therm. =
log T =
n
Recorder
Ex. Therm. =
log β =
log γ

	XX	β			
Star.	Yr 966	B Draco	α Ophi	μ Draco	γ Draco
	–	17 28 +52 24	17 29 +12 39	17 44 +72 13	17 54 +51 30
T_δ	17 22 22.2	27 18.0	28 52.3	44 7.3	53 24.2
T_m	26.6	21.3	54.4	10.5	27.6
T_e	29.8	24.9	56.4	13.7	30.7
T_f	33.8	31.6	0.7	17.1	37.5
T_g	37.8	34.9	2.8	20.8	40.8
T_h	42.0	38.3	5.0	23.9	44.2
Sum	46.0	41.7	7.1	27.4	47.3
Mean	49.7	45.2	9.1	30.7	50.7
Red. to T_m	53.8	51.8	13.4	34.1	57.4
Sum = s		55.2	15.5		0.6
$\frac{1}{5}(T_m - T_s)$		58.6	17.5		3.9
T	3797.967	3882.318	4.93.927	2611	44.082
RA	38.03 35.79	38.30 34.59	4.92 1.48	20.55 16.40	44.06 40.26
RA — T	2.24	3.71	3.49	4.15	3.80
— n tang δ					
ΔT + m					
$T_m - T_\delta$					
A					
C					
Sum					
Mean					
Red. for runs					
Red. to hor. wire					
Red. to meridian					
Division error					
Sum					
Pointer					
App. z					
log a′					
A′ log β					
λ log γ					
log tang z					
log r					
r					
z					
φ — z = δ (O)					
δ (C)					
δ (C — O)					

Date Aug 27 1871
n

Observer W.A.R.
Recorder J.F.M.

Barom. =
Att. Therm. =
Ex. Therm. =

log B =
log T =
log β =

log γ

Star.	A Draco		Gr. 2373		2 Herculis		x x x Oph.		
	16 28 +69	2	16 36 +77	42	16 39 +39	10			
T_δ									
T_m									
T_e									
T_f									
T_g									
T_h									
Sum									
Mean									
Red. to T_m									
Sum = s									
$\frac{1}{5}(T_m - T_s)$									
T									
RA									
RA — T									
— n tang δ									
ΔT + m									
$T_m - T_\delta$									
A	0 34.9		1 36.1		2 48.1		2 39.9		
C	25.7		24.2		43.0		38.1		
Sum									
Mean									
Red. for runs									
Red. to hor. wire									
Red. to meridian									
Division error									
Sum									
Pointer	25		45-x		15		50		
App. z									
log a'									
A' log β									
λ log γ									
log tang z									
log r									
r									
z									
φ — z = δ (O)									
δ (C)									
δ (C — O)									

Date Jul 27 1871	Observer W.A.R.	Barom. =	log B =	
n	Recorder J.T.M.	Att. Therm. =	log T =	
		Ex. Therm. =	log β =	log γ

Star.	ε Urs Min 16 59 +82 14	XX Gr. 966	β Draco 17 28 + 52 24	α Oph. 17 29 +12 39	δ Urs Mi 18 13 +86 36	μ Herculis 17 42 + 27 48
T_δ						
T_m						
T_e						
T_f						
T_g						
T_h						
Sum						
Mean						
Red. to T_m						
Sum = s						
$\frac{1}{s}(T_m - T_s)$						
T						
RA						
RA — T						
— n tang δ						
ΔT + m						
$T_m - T_\delta$						
A	3 57.8	1 20.0	4 11.4		2 23.0	4 47.1
C	41.8	8.2	3.0		10.4	42.5
Sum						
Mean						
Red. for runs						
Red. to hor. wire						
Red. to meridian						
Division error						
Sum						
Pointer	10	25	0		50	35
App. z						
log a′						
A′ log β						
λ′ log γ						
log tang z						
log r						
r						
z						
φ — z = δ (O)						
δ (C)						
δ (C — O)						

Date Aug 27 1872 Observer WAR
n Recorder

Barom. =
Att. Therm. =
Ex. Therm. =

log B =
log T =
log β =
log γ

Time stars for Trans-Atlantic Longitude.

Star.	×× α Scorpii	A Draco.	3 Herculis	κ Oph.	ε Urs Min.	×× 44 Oph.	~~B Draco.~~	α Oph.
		16 28 + 69 2	16 39 + 31 50	16 52 + 9 34	16 59 + 82 14	17		17 29 + 12 39
T_δ	16 21 24.9	28 9.1	38 19.8	51 29.1	58 49.6	18 24.9		28 52.3
T_m	27.3	12.1	22.3	31.1	56.7	27.2		54.3
T_e	29.4	15.1	25.0	33.3	3.0	29.5		56.3
T_f	34.2	18.0	30.4	37.6	12.8	34.0		0.4
T_g	36.4	20.7	33.0	39.7	20.8	36.3		2.7
T_h	38.8	23.4	35.6	41.7	28.1	38.5		4.7
Sum	41.1	26.3	38.3	43.7	35.8	40.8		6.9
Mean	43.3	29.3	41.0	45.8	43.3	42.9		9.0
Red. to T_m	47.8	32.0	46.2	50.1	50.9	47.5		13.1
Sum = s	50.3		48.9	52.2		49.8		15.3
$\frac{1}{5}(T_m - T_s)$	52.5		51.6	54.3		52.1		17.5
T	3873.727	2067.667	3565.645	41.691	20.333	38500		4773
RA	38.71 35.46	20.62 16.83	35.63 32.16	41.67 38.26	20.23 15.14	38.48 35.33		4.75 1.41
RA — T	3.25	379	3.47	3.41	5.09	3.15		334
— n tang δ								
ΔT + m								

			Time stars		Pole stars		
			n = −.231		n		
$T_m - T_\delta$	16	21	0 = +3.25 −.49 +.11	3.36	0 = 3.79 + 2.61 −.15 − .60	3.19	
A	16	38	3.47 + .81 − 18	29	5.09 + 7.34 − .24 − 1.69	3.40	
C	16	51	3.41 + .17 − 4	37	3.53 + 2.58 − .24 − .59	3.34	
Sum	17	18	3.15 − .45 + 10	25	4.07 + 3.12 − .24 − .72	3.35	
Mean	17	28	3.34 + .22 − 5	29	7.32 + 16.83 − .24 − 3.89	3.43	
Red. for runs	17	41	3.44 + .53 − 12	32	4.27 + 3.81 − .25 − 88	3.39	
Red. to hor. wire	17	53	3.59 + 1.26 − 29	30	3.86 + 2.41 − .23 − .56	3.30	
Red. to meridian	18	28	3.28 − 39 + 9	37	− .231	3.34	
Division error	18	06	3.30 − 15 + 3	33			
Sum	18	38	3.50 + 50 − 18	32			
Pointer	18	45	3.45 + .65 − 15	30			
App. z	18	47	3.15 − .50 + 12	27			
	19	10	3.23 − 30 + 8	31			
log a'							b = +35
A' log β	17	50	0 = +3.35 + .16	3.31	b = +38		m = 47 + 21 = +68
λ log γ					m = .38 × 1.35 − .231 × .91		
log tang z					= +.51 + .21 = .72		
log r			dT + m = 3.31	3.31			
r			m = +.72	68			
z			dT = −4.03 → 3.99				
φ — z = δ (O)							
δ (C)							
δ (C — O)							

Date Jul 27 | Observer | Barom. = | log B =
n | Recorder | Att. Therm. = | log T =
Ex. Therm. = | log β = | log γ

h m ° '	17 38 +68 39	17h 42m	17h 44m	17h 54m	xx n Sagitt	δ Urs Min 18h 13m +86 36		18h 40m	x x
Star.	ω Draco	μ Herculis	ν Draco	ζ Draco	Aquilae	α Lyrae	~~ξ Cephei~~	β Lyrae	o Sagittarii
	37 37.5-	+27° 48	+72 13	+51 30	xx 18 13 18	18 33 +38 40		+33 13	
T_δ 17	~~ω Draco~~	41 18.3	44 6.3	53 23.9	28 7.6-	32 26.0	~~45~~- 12.1	45- 12.1	47 11.4
T_m	40.4	20.5-	16.3	27.4	9.7	28.7	14.4	14.4	13.8
T_e	43.4	22.9	13.8	30.6	11.6	31.4	16.9	16.9	16.0
T_f	46.3	27.6	17.1	37.2	15.8	36.5-	21.8	21.8	20.6
T_g	48.9	30.0	20.4	40.4	17.7	39.3	24.3	24.3	23.0
T_h	51.5-	32.3	23.8	43.8	19.8	41.9	26.6	26.6	25.3
Sum	54.5-	34.7	27.2	47.8	22.0	44.4	29.3	29.3	27.5-
Mean	57.3	36.9	30.8	50.5-	24.0	47.2	31.8	31.8	29.8
Red. to T_m	0.2	41.5-	34.0	57.0	28.3	52.5-	36.4	36.4	34.5-
Sum = s		43.8		0.5-	30.2	55.1	39.1	39.1	36.7
$\frac{1}{s}(T_m - T_s)$		46.1		3.8	32.4	57.7	41.4	41.4	39.1
T	48.89 .889	32.24 .236	20.41	43.84 .836	19.91 .909	41.882		26.74 736	25.25 .245
RA	48.85- 44.92	32.22 28.78	20.36 16.29	43.82 40.23	19.89 16.59	41.86 38.36		26.72 23.27	25.23 22.08
RA — T	3.93	3.44	4.07	3.59	3.30	3.50		3.45-	3.15-
— n tang δ									
ΔT + m									
$T_m - T_\delta$									
A									
C									
Sum									
Mean									
Red. for runs									
Red. to hor. wire									
Red. to meridian									
Division error									
Sum									
Pointer									
App. z									
log a'									
A' log β									
λ' log γ									
log tang z									
log r									
r									
z									
φ — z = δ (O)									
δ (C)									
δ (C — O)									

Date July 27 Observer Barom. = log B =

Att. Therm. = log T =

n Recorder Ex. Therm. = log β = log γ

Star.	x x 50 Draco	xx d Sagittarii	δ Draconis 19 13 +67 26	xx w, Sagittarii	δ Urs Min 18 13 +86 36			
T_δ	18 50 21.7	10 1.2	12 27.5	18 06 7.7	12 30.1			
T_m	25.8	3.4	29.9	8.8	6.3			
T_e	29.5	5.7	32.8	9.9	24.4			
T_f	33.7	9.9	35.4	10.8	42.6			
T_g	37.7	12.2	38.2	12.0	59.1			
T_h	42.0	14.3	41.0	13.0	16.9			
Sum	46.0	16.4	43.7	14.2	33.5			
Mean	50.6	18.7	46.3	15.3	51.6			
Red. to T_m	54.2	23.0	49.1	16.4	7.9			
Sum = s		25.1						
$\frac{1}{5}(T_m - T_s)$		27.3						
T	3784 4	1429 1	3821 1	1201 1	59.16 155			
RA	37.78 33.51	14.27 11.04	38.17 34.31	11.99 8.71	58.89 1.57			
RA — T	4.27	3.23	3.26	3.28	7.32			
— n tang δ								
ΔT + m								

$T_m - T_\delta$								
A								
C								
Sum								
Mean								
Red. for runs								
Red. to hor. wire								
Red. to meridian								
Division error								
Sum								
Pointer								
App. z								
log a′								
A′ log β								
λ log γ								
log tang z								
log r								
r								
z								
φ — z = δ (O)								
δ (C)								
δ (C — O)								

Date July 28 Observer Barom. = log B =

Att. Therm. = log T = log γ

n Recorder Ex. Therm. = log β =

W. A. R. obs. Time stars for trans Atlantic Longitude

Star.	τ Herculis 16 16 +46 37	× × α Scorpii	η Draco 16 21 +61 48	A Draco 16 28 +69 2	× × ζ Oph.	ζ Herc. 16 39 +39 10	κ Oph. 16 57 +9 34	× × d Herc.	ε Urs. Min. 16 59 +82 14
T_δ	16 15 40.4	21 24.6	22 12.0	28 8.7	29 58.9	38 19.4	51 28.8	56 42.8	58 49.0
T_m	43.5	26.8	14.2	11.7	0.9	22.0	30.9	45.3	57.1
T_e	46.4	29.2	16.4	14.4	3.0	24.8	32.9	47.8	4.3
T_f	52.5	33.9	18.6	17.6	7.2	29.9	37.1	52.8	11.7
T_g	55.4	35.9	20.9	20.1	9.2	32.8	39.2	55.3	19.2
T_h	58.5	38.3	23.0	23.2	11.3	35.4	41.2	57.8	27.3
Sum	1.6	40.5	25.3	26.3	13.3	38.0	43.3	0.1	36.0
Mean	4.4	42.9	27.5	29.1	15.5	40.7	45.4	2.7	42.9
Red. to T_m	10.4	47.4	29.6	31.9	19.8	43.9	49.6	7.6	49.8
Sum = s	13.4	49.8			21.9	48.7	51.7	10.1	
$\frac{1}{5}(T_m - T_s)$	16.5	52.2			23.9	51.2	53.7	12.6	
T	58 46.455	38 32.318	20 84.833	20.333	11.355	35 35.345	41.26.255	57.72.718	19.700
RA	58.44 55.18	38.30 35.45	20.42 17.56 (31)	20.28 16.78	11.33 8.37	35.33 32.15	41.24 38.25	57.70 54.54	19.60 15.00
RA — T	3.26	2.85	3.26	3.50	2.96	3.18	2.99	3.16	4.60
— n tang δ									
ΔT + m									

	Time stars			Pole star.	
			n = −.210		
$T_m - T_\delta$	16 15	o = +3.26 +1.06 −.22	3.04	o = 3.26 +1.79 (−.14) −.38	2.88
A	16 21	2.85 − 49 + 11	2.96	3.50 +2.61 −.20 −.50	2.95
C	16 29	2.96 − 18 + 4	3.00	4.60 +7.84 −.22 −1.54	3.06
Sum	16 38	3.18 + 81 − 17	3.01	−.187	2.96
Mean	16 51	2.99 + 17 − 4	2.95		
Red. for runs	16 56	3.16 + 67 − 14	3.02	n = −.210	
Red. to hor. wire	17 08	3.06 + 26 − 5	3.01		
Red. to meridian	17 18	2.84 − 45 + 9	2.93		
Division error	17 27	3.23 +1.30 −.27	2.96		
Sum			2.99		
Pointer	16 49	o = +3.06 +.35		b = +.44	
App. z			dT+m = −2.99	m = +.69 + 19 = +.88	
			m = −.88		
log a'			dT = 3.87		
A' log β					
λ log γ				b = +.33	
log tang z				m = 44 + 19	= +.63
log r				dT+m	2.99
r					2.62
z					
φ — z = δ (O)					
δ (C)					
δ (C — O)					

Date July 28 Observer Barom. = log B =

n Recorder Att. Therm. = log T = ________ log γ

Ex. Therm. = log β =

XX

Star.	α Herc.,	24 of m,	β Draco,	Polaris
17h	9m +14 32	17h 28m	+52 24	
T_δ 17	08 40.7	18 24.6	27 17.5	
T_m	42.8	27.0	21.0	
T_e	45.0	29.1	24.3	
T_f	49.2	33.7	31.0	
T_g	51.4	35.9	34.4	
T_h	53.5	38.3	37.8	
Sum	55.5	40.4	41.1	
Mean	57.7	42.6	44.4	10.5 2.
Red. to T_m	1.9	47.3	51.2	37.7 2.
Sum = s	4.2	49.4	54.7	
$\frac{1}{5}(T_m - T_s)$	6.3	51.8	58.2	
T	53.473	38.190	37.782	?
RA	53 36 50 39	38.17 35.33	37.76 34.53	
RA — T	3.06	2.84	3.23	
— n tang δ				
ΔT + m				
$T_m - T_\delta$				
A				
C				
Sum				
Mean				
Red. for runs				
Red. to hor. wire				
Red. to meridian				
Division error				
Sum				
Pointer				
App. z				
log a′				
A′ log β				
λ log γ				
log tang z				
log r				
r				
z				
φ — z = δ (O)				
δ (C)				
δ (C — O)				

Date July 29 1872 Observer

n

Recorder

Barom. =

Att. Therm. =

Ex. Therm. =

log B =

log T =

log β =

log γ

W. A. R. obs. time stars for Trans Atlantic Longitude

Star.	τ Herculis	α Scorpii	η Draconis	4 Draconis	d Herc.	ε Urs. Mi.	α Herc.	44 Oph.	β Draconis
16	16^h 16^m +46° 37'		16 22^m +61° 48'	16 28^m +69 2'		16 59 +82° 14'	17 9 +14° 32'		17 28^m +52 24
T_δ	16 15 40.6	16 21 24.8	16 22 12.4	16 28 9.0	16 56	16 58 49.3	17 8 40.9	17 18 24.9	17 27 17.7
T_m	43.7	27.0	14.5	11.8		57.4	43.0	27.2	21.2
T_e	46.7	29.4	16.8	14.7		4.5	45.2	29.4	24.5
T_f	52.7	34.0	18.8	17.6	53.1	11.8	49.3	34.0	31.4
T_g	55.7	36.3	21.1	20.5	55.5	19.7	51.5	36.1	~~31.4~~
T_h	58.7	38.6	23.3	23.3	57.9	27.3	53.6	38.5	34.6
Sum	1.7	40.9	25.4	26.3	0.4	35.0	56.8	40.8	38.2
Mean	4.6	43.2	27.6	29.1	2.9	42.7	57.9	43.0	41.5
Red. to T_m	10.6	47.7	29.8	32.0		50.4	2.2	47.5	44.9
Sum = s	13.5	49.9					4.3	49.8	51.5
$\frac{1}{5}(T_m - T_s)$	16.7	52.3					6.4	52.0	54.9
T	58.66.655	38.56.555	21.08.078	20.48.478	57.960	19.76 744	53.65 645	38.403	18.3
RA	58.64 55.16	38.54 35.44	21.04 17.52	.43 16.73	57.94 54.52	19.68 14.85	53.63 50.38	38.40 35.02	38.864 38.05 35.51
RA — T	3.48	3.10	3.52	3.70	3.42	4.83	3.25	3.13	3.54
— n tang δ									
ΔT + m									

Time Stars

Pole stars.

$T_m - T_\delta$		n = -.204			
A	16 15	0 = +3.48 +1.06 -.21	+3.27	0 = +3.52 +1.79 -13 -.87	3.15
C	16 21	3.10 -49 +10	20	3.70 +2.61 -16 -53	.17
Sum	16 56	3.42 +67 -14	28	4.83 +7.35 -.21 -1.49	34
Mean	17 08	3.25 +26 ~~+~~ 5	20	3.91 +2.58 -.26 -53	38
Red. for runs	17 18	3.13 -45 +9	22	4.05 +3.12 -.26 -.63	42
Red. to hor. wire	17 27	3.54 +1.30 -27	27	-.204	3.29
Red. to meridian	17 41	3.36 +53 -11	25		
Division error	17 53	3.55 +1.26 -26	29		
Sum					
Pointer	17 07	0 = 3.35 + .45	3.26	b = .46	
App. z				m = .46 × 1.35 + .204 × .91 = 62 + 19 = +81	

dT + m = -3.26

m = +81

dT = 4.07

log a'

A' log β

λ log γ

log tang z

log r

r

z

φ — z = δ (O)

δ (C)

δ (C — O)

b = .31

m = 41 + 18 = .59

3.26

.59

3.85

Date July 29 1872 Observer W. A. R. Barom. = log B =

Att. Therm. = log T = ―――――― log γ

n Recorder Ex. Therm. = log β =

Star.	ω Draco,	μ Herc.	17h 44m ψ Draco	17h 54m ζ Draco.					
	17h 38m +68° 49'	17h 42m +27° 48'	+72 13	+51 30					
T_δ	17 37 37.4	17 41 18.2	17 44 6.8	17 53 23.9					
T_m	40.2	20.5	10.2	27.2					
T_e	43.1	22.8	13.4	30.6					
T_f	45.9	27.4	17.1	37.1					
T_g	48.8	29.8	20.4	40.5					
T_h	57.6	82.2	23.7	43.8					
Sum	54.4	84.5	27.0	47.0					
Mean	57.3	36.8	30.4	50.4					
Red. to T_m	0.2	41.4	33.7	57.0					
Sum = s	4877	43.8		0.3					
$\frac{1}{5}(T_m - T_s)$		46.1		8.7					
T	+ 48.7~~5~~767	32.14.136	20.300	43.773					
RA	41.84	32.12 28.76	20.24 16.19	43.75 40.20					
RA − T	3.91	3.36	4.05	3.55					
− n tang δ									
ΔT + m									

$T_m - T_\delta$									
A									
C									
Sum									
Mean									
Red. for runs									
Red. to hor. wire									
Red. to meridian									
Division error									
Sum									
Pointer									
App. z									
log a'									
A' log β									
λ' log γ									
log tang z									
log r									
r									
z									
φ − z = δ (O)									
δ (C)									
δ (C − O)									

Date Aug 30 1872 Observer W.A.R.

n

Recorder

Barom. =
Att. Therm. =
Ex. Therm. =

log B =
log T =
log β =

log γ

O.W. & R. Obs. Line stars for Longitude

Star.	× × 44 Oph.	17h 28m β Draco. +52 24	× × ~~α Oph.~~ 51 Oph.?	17h 38m α Draco +68 49	17h 42m μ Herc. +27 48	17h 44m ψ Draco. +72 13	17h 54m ξ Draco +51 30	× × μ2 Sagitt.	18h 13m δ Urs. Min. +86 36
T_δ	17 18 25.9	17 27 18.9	40 53.1?	17 37 38.6	17 41 19.3	17 44 8.1	17 53 25.0	17 57 27.4	18 17 7.6
T_m	28.3	22.3	3.4 1.8?	41.3	21.6	11.3	28.2	29.8	40.4
T_e	30.6	25.5	3.2 Clouds	44.2	24.0	14.8	31.6	32.4	57.0
T_f	35.0	32.4	6.9	46.9	28.6	18.1	38.3	36.9	32.5
T_g	37.3	35.7	3.3 3.4	49.9	30.9	21.4	41.4	39.3	53.8
T_h	39.6	39.1		52.7	33.3	24.5	44.8	41.8	29.3
Sum	41.8	42.4	3.3	55.5	35.5	28.2	48.2	43.9	
Mean	44.1	46.0	3.6	58.3	37.9	31.4	51.7	46.5	60.5
Red. to T_m	48.5	52.8	6.8	1.3	42.4	34.7	58.2	51.2	58.9 60.7
Sum = s	50.9	55.9	3.1	2	44.9		1.3	53.8	59.3 60.2
$\frac{1}{5}(T_m - T_s)$	53.2	58.6	7		47.3		4.6	56.2	61.4
T	39.564	× ~~39.14~~ -	~~38.93~~	49.85 .844	33.20 .245	21.422	× 44.84 .845	41.75 .745	60.17 27 59.90
RA	39.55 35.31.	39.43 34.49	39.145	49.81 44.81	33.23 28.75	21.36 16.14	44.82 40.18	41.73 37.50	60.71
RA — T	4.24	4.64 4.88		5.00	4.45	5.22	4.64	4.23	9.49
— n tang δ									
ΔT + m									
			Above Pole +4 15,4						+3 27,6
$T_m - T_\delta$			3 33,4						2 53,5
A			2 50,1						2 18,5
C			1 25,2						1 9,4
Sum			42,3						34,5
Mean			1						+ 0,1
Red. for runs			42,4						— 34,5
Red. to hor. wire			125,2						1 9,4
Red. to meridian			2 50,1						2 18,5
Division error			3 33,2						2 53,6
Sum			4 15,2						3 27,9
Pointer									
App. z									
log a′									
A′ log β									
λ log γ									
log tang z									
log r									
r									
z									
φ — z = δ (O)									
δ (C)									
δ (C — O)									

1872

Date July 30 Observer Barom. = log B =

Att. Therm. = log T = log γ

n Recorder Ex. Therm. = log β =

Star.	×× ζ Aquilae +5 9 255	$19^h 13^m$ δ Draconis +67 26 #	$19^h 19^m$ δ Aquilae #+2 52 Vrs	$19^h 18^m$ τ Draconis +73 7	
T_δ	18 59 27.6	19 12 28.7	19 17 55.1	19 18 56.8	~~19 29 54.7~~
T_m	29.7	31.2	58.5	58.0	
T_e	33.5	33.8	2.3	1.2	
T_f	36.1	36.7	5.8	5.2	
T_g	38.2	39.3	9.3	7.2	
T_h	40.3	42.0	13.0	9.3	
Sum	42.4	44.9	16.2	11.3	
Mean	46.6	47.5	19.8	13.4	
Red. to T_m	48.7	52.4	23.3	17.6	
Sum = s	50.8			19.6	
$\frac{1}{5}(T_m - T_s)$	38.16 .155 ×	3		21.8	
T	38.14 33.64	39.~~11~~ .389	39.26 .255	9.31 .309	
RA	4.50	39.45 34.25	39.20	9.29	
RA — T	4.50	5.14	5.35	4.47	
— n tang δ					
ΔT + m					

		m = −.282		n
$T_m - T_\delta$	$17^h 18^m$	o = +4.24 −.45 +13 4.37	47 38	o = 5.00 +2.58 −.27
A	17 27	+4.64 +1.30 −37 .57	17 41	5.22+3.12 −29
C	17 41	+4.48 +53 −15 33		
Sum	17 53	+4.74 +1.26 −35 39 ±.036		
Mean	17 57	+4.23 −.59 +17 40		
Red. for runs	17 49	4.37 ±.016	18 15	o = 9.19 +16.83 −.29
Red. to hor. wire				
Red. to meridian		dT+m = −4.35		b = +26
Division error		m = + .60		m = 35+25 = +60
Sum		dT = 4.95		
Pointer				
App. z	19 00	+4.50 +24 −7 4.43	19 12	o = 5.14 +2.41 −29
	19 19	+4.47 +5 −2 4.45	19 18	5.35+3.29 −27
log a'		4.44		−.282
A' log β				
λ log γ				
log tang z				b = 29
log r				m = 39+25 = +64
r				
z				
φ — z = δ (O)				
δ (C)				
δ (C — O)				

Date Aug 1872 Observer W.A.R.

n

Recorder

Barom. =
Att. Therm. =
Ex. Therm. =

log B =
log T = ______
log β =

log γ

Line Stars.

		× ×	× ×	$13^h\ 43^m$	$13^h\ 49$	$14^h\ 57^m$	$15^h\ 10^m$	$16^h\ 8^m$	$16^h\ 28^m$	× ×
Star.		Polaris	α Virginis	η Urs Maj	η Bootis	β Bootis	β Librae	δ Ophiuchi	η Draconis	ζ Ophiuchi
				+49°56'	+19°2'	+40°53	−8°55	−3°22	+69°2'	
T_δ	13 9	18.4	13 18 22.1	13 42 31.2	13 48 38.9	14 56 59.5	15 10 3.0	16 07 34.6	16 28 12.8	16 30 3.1
T_m	10	1.8	24.2	32.8	40.1	2.2	5.2	36.7	15.8	5.2
T_e	10	44.3	26.2	34.4	41.2	4.9	7.3	38.8	18.6	7.3
T_f	11	29.6	30.4	36.1	42.2	10.4	11.5	42.9	21.4	11.4
T_g	12	9.8	32.5	37.5	43.3	13.2	13.4	45.0	24.2	13.6
T_h		52.4	34.7	38.9	44.4	15.8	15.5	47.2	27.3	15.7
Sum		34.0	36.8	40.7	45.5	18.6	17.6	49.1	30.2	17.8
Mean		19.0	38.9	42.3	46.5	21.3	19.7	51.2	33.2	19.9
Red. to T_m		2.0	43.0	43.9	47.5	26.7	23.9	55.2	36.0	24.1
Sum = s			45.0			29.4	26.0	57.3		26.2
$\frac{1}{5}(T_m - T_s)$			47.2			32.2	28.1	59.5		28.2
T		12^h 10.[illegible]144	34.64.636	37.54.533	43.30.289	15.84.836	15.57.564	47.05.045	24.39.389	15.682
RA		10.72 14.23	34.62 27.61	37.52 80.13	43.28 36.06	15.82 8.46	11.55 8.36	47.03 39.75	24.35 16.52	15.67 8.32
RA − T		−3.51	+7.01	+8.39	+7.21	+7.36	+7.19	7.28	7.88	7.35
— n tang δ										
ΔT + m										

ΔdT assumed = .09ˢ per hour.

$T_m - T_\delta$ n = −.26 n

A 13 18 0 = +7.01 +.08 +7.09 −1.9 +.04 7.13 13 12 0 = −3.51 + 41.83

C 13 42 7.32 +.05 7.44 +1.19 −31 7.18 = −3.51 + 9 = −3.42 − 41.83 −.25

Sum 13 48 7.21 +.04 7.25 + 34 − 9 7.16 ±0.12

Mean 14 56 7.36 +.07 7.29 +.87 − 18 7.11

Red. for runs 15 09 7.19 − 9 7.10 −.16 + 3 7.13

Red. to hor. wire 14 11

Red. to meridian 7.36 7.36 + .41 7.13 ±.005

Division error

Sum

Pointer

App. z

log a'

A' log β

λ log γ

log tang z

log r

r

z

φ − z = δ (O)

δ (C)

δ (C — O)

Date Aug 1872 Observer

n Recorder

Barom. =
Att. Therm. =
Ex. Therm. =

log B =
log T =
log β =

log γ

	16h 52m	X X	16h 59m	17h 9m	17h 42m	18h 13m	X X	18h 45m
Star.	κ Ophiuchi	d Herculis	δ Urs. Min.	a' Herculis	μ Herculis	δ Urs. Min	51 Ceph.	β Lyrae.
	+9 34		+82 14	+14 32	+27 28	+86 36		+33 13
T_δ	16 51 41.5	16 56 47.2	16 58 53.0	17 08 45.0	17 41 22.4	18 12 53.0	18 38 5.5	18 45 16.2
T_m	42.6	49.6	0.9	47.2	24.8	10.6	26.3	18.6
T_e	43.6	52.1	8.7	49.3	27.0	26.8	47.5	21.1
T_f	44.7	57.0	15.9	53.6	31.6	46.0	10.3	26.0
T_g	45.6	59.5	24.3	55.7	34.0	4.3	32.5	28.4
T_h	46.6	1.9	31.4	57.7	36.3	20.2	52.2	30.9
Sum	47.7	4.5	39.4	0.0	38.6	37.5	14.7	33.4
Mean	48.8	6.9	46.7	2.0	40.9	54.8	34.6	35.9
Red. to T_m	49.8	12.0	54.3	6.4	45.5	12.5	56.5	40.8
Sum = s		14.5		8.4	48.0			43.2
$\frac{1}{5}(T_m - T_s)$		16.9		10.6	50.2			45.7
T	45655	2.01.009	2.3 844	57.72 .718	36.300	2.856	~~3200~~ 31.122	30.93 .927
RA	45.64 88.21	1.99 54.49	23.67 14.40	57.70 $\frac{94}{808}$ 50.34	36.28 28.72	2.58 50.07	32.56 29.4	30.89 23.24
RA − T	+ 7.43	+ 7.50	+ 9.27	+ 7.36	+ 7.56	+ 12.51	+ 3.12	+ 7.65
− n tang δ								
ΔT + m								

			4 dT = +.09		n = −26			n
$T_m - T_\delta$	16 07	0 = +7.28 +05		7.33 − 06 +02	7.35	16 28	0 = 7.83+11−7.54+.261	−.23
A	16 30	7.35 + 2		7.37 − 18 + 5	7.42			
C	16 51	7.43 − 1		7.42 + 17 − 4	7.38 ±.044			
Sum	16 56	7.50 − 2		7.48 + .67 − 18	7.30			
Mean	17 08	7.36 − 4		7.32 + .26 − 7	7.25			
Red. for runs	16 42							
Red. to hor. wire			0 = 7.38 + .17		7.34 ±.119			
Red. to meridian								
Division error								
Sum	17 41	7.56 − 09		7.47 + .53 − 14	7.33			
Pointer								
App. z								
log a'								
A' log β								
λ log γ								
log tang z								
log r								
r								
z								
φ − z = δ (O)								
δ (C)								
δ (C − O)								

Date Aug 1 1872 Observer

n Recorder

Barom. =

Att. Therm. =

Ex. Therm. =

log B =

log T = ____________

log β =

log γ

	× ×	× ×	× ×	× ×	19h 18m		19h 45m	19h 49m	19h 49m
Star.	o Sagittarii	60 Draconis	ζ Aquilae	δ Sagittarii	τ Draconis +73° 7′		κ Aquilae +8° 32′	β Aquilae +6° 6′	λ Urs. Min. +88° 56′
T_δ	1847 15.8	1850 25.3	1859 28.6	1910 5.5	1917 58.2	1918 8.3	1944 29.4	1948 58.9	1949 47.0
T_m	17.9	29.9 46	30.6	7.7	1.8	10.3	31.5	1.0	50 41.8
T_e	20.4	33.9 40	32.8	9.7	5.1	12.4	33.8	2.9	51 36.1
T_f	25.0	38.1 42	37.0	14.2	8.5	14.4	37.9	7.2	52 31.7
T_g	27.2	41.9 38	39.1	16.4	12.4	16.3	40.0	9.3	53 30.0 −
T_h	29.5	46.2 43	41.2	18.5	15.7		41.9	11.3	54 21.3
Sum	31.8	49.9 37	43.3	20.8	19.1		44.2	13.4	55 12.8
Mean	34.2	53.8 35	45.4	22.9	22.7		46.2	15.5	56 9.8
Red. to T_m	38.7	58.3 45	49.7	27.3	26.6		50.3	19.7	57 20.0
Sum = s	41.0		51.8	29.4			52.5	21.7	
$\frac{1}{5}(T_m - T_s)$	43.4		54.0	31.6			54.5	23.7	
T	29.54.536	41.922	41.28.227	15.55.545	12233		42.02.018	11.33.327	53.27.833
RA	29.52 22.08	41.87 83.28	41.21 83.64	14.53 11.05	12.18 3.77		42.00 34.39	11.31 3.62	83 53.27.00
RA − T	7.44	8.59	7.57	7.48	8.41		7.61	7.65	4.70 +22.30
− n tang δ									
ΔT + m									

				A dT = .09 5	n = 2.60				
$T_m - T_\delta$	18 45	0 = 7.65	+.06	+ 7.71 +65	−17 + 7.54	18 12	0 = 12.57 +10	12.61 + 16.83	.31
A	18 47	7.44	+ 5	7.49 ~~+50~~ +13	7.62	18 37	3.12 + 6	3.18 ÷ 20.83	.21
C	18 59	7.57	+ 3	7.60 +24 + 5	7.55	18 50	8.57 +4	8.63 + 3.81	.28
Sum	19 10	7.48	+ 1	7.49 −35 + 9	7.58	19 18	8.41 + 0	8.41 + 3.29	.26 106 .27
Mean	19 44	7.61	− 4	7.57 +05 − 1	7.56	18 44			
Red. for runs	19 48	7.65	− 5	7.60 + 06 − 1	7.59				
Red. to hor. wire					7.57 ±.008				
Red. to meridian	19 17	7.57		7.58 + 11		19 52	0 = 2230 − 5	2220 ÷ 5328	.28
Division error						hourly rate	mean		
Sum				ΔT+m = −7.57.	d − 19h 17m	= +.089 .5			1 25 25
Pointer				7.34	16 42	= +.084	.086		1 23 23
App. z				7.13	14 11 =				4 27 108
									1 28 28 184 7 .26
log a′	b = +12			dT = 7.96	d − 19 17	8.05			
A′ log β	m = +16 + 23 = +39			7.93	16 42	7.82			
λ log γ				7.52	14 11	7.61			
log tang z	Corr. b = +18	n = 27				23.48			
log r	m = 24 + 24 = 48			7.74	16 43	7.83			
r				~~39~~					
z				~~813~~			b = ~~28~~		
φ − z = δ (O)							m = 37 + 24 = .61		
δ (C)									
δ (C − O)									

Date Aug 4/72 Observer W.A.R.

n

Recorder J

Barom. =

Att. Therm. =

Ex. Therm. =

log B =

log T =

log β =

log γ

Time Stars

Star.	XX Polaris	XX α Virginis	14h 10m α Bootis +19° 50'	14h 57m β Bootis +40° 53'	15h 10m β Librae −8° 55'	16h 22m η Draconis +61° 48'	XX ζ Ophiuchi	√ 16h 39m η Herculis +39° 10'	
T_δ	13 09 31.6	13 18 29.5	14 09 51.6	14 56 7.0	15 09 10.6	16 22 23.5	16 30 10.7	16 38 31.0	
T_m	10 16.6	31.5	53.8	9.6	12.7	25.8	12.7	33.5	2.5
T_e	10 56.2	33.6	55.9	12.3	14.8	27.9	14.7	36.4	2.9
T_f	11 39.1	37.9	0.4	17.8	18.9	30.4	19.0	41.7	5.3
T_g	12 22.6	39.9	2.6	20.6	21.0	32.6	20.9	44.3	2.6
T_h	3.0	42.1	4.9	23.2	23.1	34.8	23.1	46.9	2.6
Sum	49.2	44.1	7.1	26.0	25.1	37.1	25.2	49.7	2.8
Mean	31.4	46.2	9.2	28.8	27.2	39.1	27.2	52.3	2.6
Red. to T_m	10.3	50.4	13.6	34.2	31.4	41.3	31.4	57.5	5.2
Sum = s		52.6	15.7	36.8	33.5		33.6	0.1	2.6
$\frac{1}{5}(T_m - T_s)$		54.6	17.9	39.5	35.6		35.7	2.7	2.6
T	22.222	42.04 .036	47.91 ×	23.21 .255	23.082	32.500	23.11 .109	46.92 .918	
RA	22.85 16.41	42.02 27.57	4.77 50.08	23.20 8.39	23.06 8.33	32.47 17.29	23.09 8.31	46.50 82.02	
RA — T	+6.44	14.45	14.69	14.86	14.73	15.18	14.78	14.88 Rej why?	
— n tang δ									
ΔT + m									

Δ dT assumed = +.010 per hour.
n = −.18

$T_m - T_\delta$ 16 29 0 = +14.78 + 06 14.84 − 18 + 03 14.87 06 22 0 = 15.18 + 7 15.25 7.186 − 16 7 49

A 16 51 14.98 + 3 15.01 + 17 − 3 .98 16 59 15.89 + 1 15.90 + 7.34 (11) 4 16

C 16 56 15.04 + 2 15.06 + 67 − 12 94 0 0

Sum 17 27 15.25 − 4 15.21 + 1.30 − 23 98 4 16

Mean 17 41 15.09 − 6 15.03 + .53 − 10 93 1 1

Red. for runs 17 06 4.70 .0082

Red. to hor. wire 0 = +15.03 + 0.50 14.94 ± .012 .00205 ±.030

Red. to meridian

Division error

Sum

Pointer

App. z

log a' n = −.18

A' log β 13 18 0 = 14.45 + 11 14.56 − 19 + 03 14.59 13 12 0 = +6.44 + 12 = +6.56 − 41.83 −.20 m

λ log γ 14 09 14.69 + 2 14.71 + 36 − 6 65

log tang z 14 16 14.86 − 5 14.81 + 87 − 15 66

log r 15 09 14.73 − 8 14.65 − 16 + 3 68

r 14 23 14.63

z 0 = 14.68 + 22

φ — z = δ (O)

δ (C)

δ (C — O)

Date Aug 4

n

Observer

Recorder

Barom. =

Att. Therm. =

Ex. Therm. =

log B =

log T =

log β =

log γ

Star.	16h 52m κ Ophiuchi +9 34'	×× δ Herculis	16h 59m ε Urs. Min. +82° 14'	.	17h 28m β Draconis +52° 24'	17h 42m ω Herculis +27 48
T_δ	16 51 40.6	16 56 54.7	16 58 59.4	17 22 34.5	17 27 29.2	17 41 29.7
T_m	42.8	57.0	14.8 15.4	38.5	32.7	32.2 25
T_e	44.8	59.6	22.3 75	42.6	36.2	34.6 2.4
T_f	49.0	4.6	30.1 78	46.7	42.9	39.2
T_g	51.1	7.0	37.9 78	50.8	46.3	41.4
T_h	53.3	9.4	45.6 67	54.6	49.7	43.8
Sum	55.2	12.0	1507	58.5	52.9	46.2
Mean	57.4	14.6	29.94	2.8	56.4	48.5
Red. to T_m	1.5	19.3		6.4	3.1	53.2
Sum = s	3.5	21.9			6.7	55.3
$\frac{1}{5}(T_m - T_s)$	5.7	24.4			10.0	57.8
T	53173	95000	30.14 ~~29.94~~	50.600	4961.645 ×	43.77 ~~[illegible]~~
RA	53.16 28.18	9.48	29.84 13.95		49.62 34.31	43.79 809 28.70
RA — T	14.98	8744 15.04	15.89		16.25	15.09
— n tang δ						
ΔT + m						

$T_m - T_\delta$

A

C

Sum

Mean — ΔT+m at 14h 23m 14.63 } Hourly rate = +.115

Red. for runs — ΔT+m at 17h 5m = 14.94 }

Red. to hor. wire

Red. to meridian — Daily rate between Aug 1 and Aug 4 = 2.49

Division error — Hourly rate between dates = +.104

Sum

Pointer — b = +.17

App. z — m = 23 + 17 = +40

log a' — dT at 14 23 = 15.03 — b = .27

A' log β — at 17 05 15.34 — m = +36 + 16 = +.52

λ log γ

log tang z — 15 44 = -15.18

log r

r

z

φ — z = δ (O)

δ (C)

δ (C — O)

Date Aug 5 1872 Observer W.A.R. Barom. = log B =

n Recorder Y Att. Therm. = log T = log γ

Ex. Therm. = log β =

Time Stars

	x x	16h 22m	16h 28	16h 39m	16h 52m	x x	16h 59m	17h 9m
Star.	α Scorpii	η Draconis +61°48	A Draconis +69° 2'	η Herculis +39° 10	κ Ophiuchi +9° 34'	d Herculis	ε Urs Min +82° 14	α' Herculis +14° 32'
T_δ	16 21 38.9	16 22 26.0	16 28 22.7	16 38 33.6	16 51 43.0	16 56 57.2	16 59 1.8	17 08 55.1
T_m	41.2	28.4	25.5	36.2	45.3	59.6	9.9	57.3
T_e	43.6	30.6	28.5	38.9	47.2	2.1	17.3	59.3
T_f	48.1	32.7	31.3	44.3	51.4	7.2	25.2	3.6
T_g	50.4	34.9	34.2	46.9	53.6	9.6	32.9	5.7
T_h	52.6	37.1	37.0	49.5	55.6	12.1	40.9	7.8
Sum	55.0	39.3	39.8	52.2	57.7	14.4	48.3	10.0
Mean	57.3	41.4	42.8	54.8	59.7	17.0	56.0	12.1
Red. to T_m	1.7	43.5	45.7	0.3	4.1	21.9	3.6	16.3
Sum = s	4.3			2.8	5.9	24.5		18.5
$\frac{1}{5}(T_m - T_s)$	6.6			5.5	8.2	26.9		20.6
T	~~55.310~~ 52.700	34.878	34.167	49.545	55.609	12.045	32.878	7.845
RA								
RA — T								
— n tang δ								
ΔT + m								
$T_m - T_\delta$								
A								
C								
Sum								
Mean								
Red. for runs								
Red. to hor. wire								
Red. to meridian								
Division error								
Sum								
Pointer								
App. z								
log a′								
A′ log β								
λ′ log γ								
log tang z								
log r								
r								
z								
φ — z = δ (O)								
δ (C)								
δ (C — O)								

Date

n

Observer

Recorder

Barom. =

Att. Therm. =

Ex. Therm. =

log B =

log T =

log β =

log γ

	$17^h 42^m$	$17^h 44^m$	$17^h 54$	x x	x x	$18^h 13^m$
Star.	ω Herculis	ψ Draconis	ζ Draconis	ζ² Sagittarii	ω Sagitt	δ Ursae Min.
	+27° 48'	+72° 13'	+51° 30'			+86° 36'
T_δ	17 41 33.4	17 44 20.6	17 53 38.6	17 57 40.4	18 06	18 13 0.6
T_m	34.8	27.2	41.4	42.8		18.3
T_e	37.0	34.2	44.6	45.3		35.4
T_f	41.7	40.8	51.3	50.2	21.7	53.8
T_g	44.0	47.7	54.6	52.5	23.9	11.0
T_h	46.3		58.0	55.0	26.3	28.5
Sum	48.7		1.2	57.3	28.5	45.1
Mean	50.9		4.5	59.6	30.6	3.0
Red. to T_m	55.7		11.2	4.5		20.8
Sum = s	57.9		14.4	7.0		
$\frac{1}{5}(T_m - T_s)$	0.3		17.8	9.2		
T	46.427	34.100	57.909	54.891	26.200	10.722
RA						
RA — T						
— n tang δ						
ΔT + m						
$T_m - T_\delta$						
A						
C						
Sum						
Mean						
Red. for runs						
Red. to hor. wire						
Red. to meridian						
Division error						
Sum						
Pointer						
App. z						
log a'						
A' log β						
λ log γ						
log tang z						
log r						
r						
z						
φ — z = δ (O)						
δ (C)						
δ (C — O)						

47^m = 1750 at $14^h 24^m$

45 = 1749 " "

Date Aug 5 Observer W.A.R. Barom. = log B =

Att. Therm. = log T = log γ

n Recorder J.F.M. Ex. Therm. = log β =

Fundamental Stars for Zone.

Star.									
T_δ									
T_m									
T_e									
T_f									
T_g									
T_h									
Sum									
Mean									
Red. to T_m									
Sum = s									
$\frac{1}{\delta}(T_m - T_s)$									
T									
RA									
RA — T									
$- n \tan \delta$									
$\Delta T + m$									
$T_m - T_\delta$									
A									
C									
Sum									
Mean									
Red. for runs									
Red. to hor. wire									
Red. to meridian									
Division error									
Sum									
Pointer									
App. z									
log a′									
A′ log β									
λ log γ									
log tang z									
log r									
r									
z									
$\phi - z = \delta\,(O)$									
$\delta\,(C)$									
$\delta\,(C - O)$									

Date
Observer
Barom. =
log B =

Att. Therm. =
log T =
log γ

n
Recorder
Ex. Therm. =
log β =

Star.									
T_δ									
T_m									
T_e									
T_f									
T_g									
T_h									
Sum									
Mean									
Red. to T_m									
Sum = s									
$\frac{1}{5}(T_m - T_s)$									
T									
RA									
RA — T									
— n tang δ									
ΔT + m									
$T_m - T_\delta$									
A									
C									
Sum									
Mean									
Red. for runs									
Red. to hor. wire									
Red. to meridian									
Division error									
Sum									
Pointer									
App. z									
log a′									
A′ log β									
λ log γ									
log tang z									
log r									
r									
z									
φ — z = δ (O)									
δ (C)									
δ (C — O)									

Date
n

Observer
Recorder

Barom. =
Att. Therm. =
Ex. Therm. =

log B =
log T =
log β =

log γ

Star.									
T_δ									
T_m									
T_e									
T_f									
T_g									
T_h									
Sum									
Mean									
Red. to T_m									
Sum = s									
$\frac{1}{5}(T_m - T_s)$									
T									
RA									
RA — T									
— n tang δ									
$\Delta T + m$									
$T_m - T_\delta$									
A									
C									
Sum									
Mean									
Red. for runs									
Red. to hor. wire									
Red. to meridian									
Division error									
Sum									
Pointer									
App. z									
log a′									
A′ log β									
λ log γ									
log tang z									
log r									
r									
z									
$\phi - z = \delta$ (O)									
δ (C)									
δ (C — O)									

Date
Observer
Barom. =
log B =
Att. Therm. =
log T =
log γ
n
Recorder
Ex. Therm. =
log β =

Star.									
T_δ									
T_m									
T_e									
T_f									
T_g									
T_h									
Sum									
Mean									
Red. to T_m									
Sum = s									
$\frac{1}{5}(T_m - T_s)$									
T									
RA									
RA — T									
— n tang δ									
$\Delta T + m$									
$T_m - T_\delta$									
A									
C									
Sum									
Mean									
Red. for runs									
Red. to hor. wire									
Red. to meridian									
Division error									
Sum									
Pointer									
App. z									
log a′									
A′ log β									
λ log γ									
log tang z									
log r									
r									
z									
$\phi - z = \delta$ (O)									
δ (C)									
δ (C — O)									

Date Aug 6 1872 Observer W.A.R.

n

Recorder

Barom. =
Att. Therm. =
Ex. Therm. =

log B =
log T =
log β =

log γ

Time Stars.

Star.	×× Polaris +1	×× α Virginis	16h 43m η Urs Maj +49° 56'	13h 49m η Bootis +19° 2	14h 10m α Bootis +19° 30'	16h 39m η Herculis +39° 10'	16h 52m κ Ophiuchi +9° 34'	×× ε Herculis
T_δ	13 8 34.0	13 18 34.6	13 42 30.3	13 48 42.7	14 8 56.8	16 38 36.4	16 51 45.7	16 56 39.7
T_m	9 19.0	36.7	34.0	44.8	58.1	38.7	47.7	2.3
T_e	10 3.5	38.7	37.2	47.0	1.0	41.3	49.8	4.7
T_f	10 41.3	42.9	43.5	51.4	5.4	46.8	54.1	9.6
T_g	11 28.7	45.0	46.5	53.6	7.7	49.3	56.2	12.2
T_h	12 2.6	47.1	50.0	55.8	10.0	52.2	58.3	14.6
Sum	12 53.7	49.2	53.3	57.8	12.1	54.8	0.3	17.0
Mean	13 35.9	51.3	56.4	0.1	14.3	57.5	2.4	19.7
Red. to T_m	14 20.1	55.4	2.8	4.5	18.7	2.7	6.6	24.4
Sum = s	× 12 27.92 755	57.5	5.9	6.7	20.9	5.5	8.6	27.0
$\frac{1}{5}(T_m - T_s)$	2.833 17.78	59.6	9.0	8.8	23.0	8.1	10.8	29.4
T	+ 10.55	47.091	49.973	55.745 ×	9.812 818	62.164	58.23.227	14.600
RA		47.07 27.55	49.95 30.02	55.72 36.00	9.80 30.03	52.14 31.98	58.21 38.15	14.58 54.39 50.19
RA — T		19.52	19.93	19.72	19.83	20.16	20.06	20.19
— n tang δ								
ΔT + m								

dΔT assumed = +.12s

n = −.20 n = −.22

$T_m - T_\delta$	13 18	0 = 19.52 +44	19.56 −.19 +04	19.60	6 26 0 = 10.55+10 = 10.65 − 41.81 − .22
A	13 42	19.93 + 0	19.93+1.19 − 24	.69	3 9
C	13 48	19.72 − 1	19.71+.34 − 7	64	2 4
Sum	14 09	19.83 − 5	19.78+.36 − 7	65	5 25
Mean	13 44		19.75 + .42	19.66	94 .0025 ±.034
Red. for runs					
Red. to hor. wire			b = +.21		
Red. to meridian			m = +.28+.18 = +.46		
Division error		dT+m		= − 19.66	
Sum		dT		20.12	
Pointer					
App. z			n = −.223		
		o = 19.56 −.19 +.04		19.60	
log a'		19.93+1.19 − 27		66	
A' log β		19.71 + .34 − 7		64	
λ log γ		19.78 + .36 − 8		70	
log tang z					
log r				19.65 at 13h 44m	
r					
z					
φ — z = δ (O)					
δ (C)					
δ (C — O)					

Date
Observer
Barom. =
Att. Therm. =
Ex. Therm. =
log B =
log T =
log β =
log γ
n
Recorder

	16h 59m	17h 9m	λ x	17h 28m	17h 42m	17h 44m	17h 54m	18h 13m
Star.	ε Urs. Min	α Herculis	44 Ophiuchi	β Draconis	μ Herculis	ψ Draconis	γ Draconis	δ Urs. Min
	+82° 14′	+14° 32′		+52° 24′	+27° 48′	+72° 18′	+51° 30′	+86° 36′
T_δ	16 59 5.3	17 8 57.6	17 18 41.6	17 27 34.5	17 41 36.0	17 44 23.3	17 53 40.7	18 13 4.1
T_m	12.2	59.7	43.8	37.8	37.2	26.4	43.9	20.8
T_e	19.6	1.9	46.1	41.2	39.6	29.9	47.2	38.5
T_f	28.0	6.2	50.6	47.9	44.2	33.2	53.8	55.1
T_g	35.5	8.3	53.0	51.4	46.6	36.8	57.1	13.4
T_h	43.0	10.4	55.3	54.7	48.9	40.0	0.6	30.7
Sum	51.0	12.5	57.4	58.1	51.2	43.4	3.7	47.7
Mean	58.5	14.6	59.7	1.4	53.6	46.8	7.0	5.6
Red. to T_m	6.1	16.9	4.3	8.2	58.1	50.2	13.6	23.2
Sum = s		21.0	6.5	11.6	0.6		17.0	
$\frac{1}{5}(T_m - T_s)$	0	23.1	8.7	14.9	2.8		20.3	
T	85.47 467	10.382	55.182	54.700	48.891	36.67 .667	0.45 445	13.24 233
RA	35.87 13.64	10.36 50.29	55.16 35.25	54.700 34.32	48.87 28.68	36.61 57.74	43 40.04	13.98 48.56
RA — T	13.54 21.73	20.07	19.91	20.38	20.19	20.87	20.39	24.42
— n tang δ								
ΔT + m								

4dT = .42

n

$T_m - T_\delta$	16 38 0 = 20.16 + 07	+20.23 + 81 − 18	+20.05	1	1	16h 59 0 = 21.73 + 3 + 21.76 + 7.84 − 23
A	16 57	20.06 + 5	20.11 + 17 − 4	.07	3	9	17 44 20.87 − 5 20.82 + 3.12 − 25
C	16 56	20.19 + 3	20.22 + 67 − 15	07	3	9	18 13 24.42 − 11 24.31 + 16.83 − 26
Sum	17 08	20.07 + 1	20.08 + 26 − 6	02	2	4	
Mean	17 18	19.91 − 1	19.90 − 45 + .10	00	4	16	
Red. for runs	17 27	20.38 − 2	20.36 + 1.30 − 29	07	3	9	
Red. to hor. wire	17 41	20.19 − 5	20.14 + 53 − 12	02	2	4	
Red. to meridian	17 53	20.39 − 8	20.31 + 1.26 − 28	03	1	1	
Division error					.0053		
Sum	17 14			20.04 ± .006	.0076		
Pointer					±.019		
App. z							

log a′
A′ log β
λ′ log γ
log tang z
log r
r
z
φ — z = δ (O)
δ (C)
δ (C — O)

k = +.23
m = .31 + .18 = .49

Date Aug 6 1872 Observer W.H.R.
n
Recorder

Barom. =
Att. Therm. =
Ex. Therm. =

log B =
log T =
log β =
log γ

	18h 33m	xx	18h 45m	xx	19h 0m	xx	19h 18m	19h 19m
Star.	α Lyrae	51 Cephei	β Lyrae	σ Sagittarii	ζ Aquilae	d Sagittarii	τ Draconis	δ Aquilae
	+38° 40'		+33° 13'		+13° 41'		+73° 7'	+2° 52'
T_δ	18 32 42.8	18 38 20.8	18 45 28.9	18 47 28.5	18 59 41.3	19 10 18.2	19 18 10.7	19 19 12.8
T_m	45.4	42.7	31.3	30.8	43.5	20.5	14.0	14.8
T_e	48.1	5.6	33.8	33.0	45.5	22.6	17.7	16.9
T_f	53.5	24.8	38.8	37.6	49.8	27.0	21.2	21.0
T_g	56.1	− 47.3	41.2	39.9	57.9	29.2	24.8	23.0
T_h	58.8	7.4	43.7	42.3	54.0	31.3	28.4	25.2
Sum	1.3	28.6	46.1	44.6	56.1	33.5	31.8	27.2
Mean	4.0	52.1	48.6	46.8	58.2	35.7	35.3	29.2
Red. to T_m	9.3	11.8	53.4	57.5	2.5	40.1	38.8	33.4
Sum = s	12.0		56.0	52.7	4.6	42.2		35.5
$\frac{1}{5}(T_m - T_s)$	14.5		58.4	56.1	6.7	44.4		37.6
T	58.71.709	46.79.789	43.656	42.256	54 01.009	31.34.336	25.85 24.744	25.15.145
RA	58.69 38.26	47.12 31.13	43.64 23.21	42.24 22.06	53.99 33.62	31.32 11.05	25.80 24.70 5.?? 3.59	25.13 4.82
RA − T	20.48	15.99	20.43	20.18	20.37	20.27	21.27 21.11	20.31
− n tang δ								
ΔT + m								

dΔT = +1.2 per hour.

n = −20

									n
$T_m - T_\delta$	18 32	0 = +20.48 + 4	20.47 +50 −16	20.31	18 38	0 = 15.99 +0.3	16.02 − 20.72	− .20	1 1
A	18 45	20.43 + 2	20.45 +65 −13	32	19 18	22.21 − 5	21.16 + 3.29	− .22	2 3
C	18 47	20.18 + 1	20.19 −50 +10	29					1 1
Sum	18 59	20.37 − 1	20.36 +24 −5	31					1 1
Mean	19 10	20.27 − 3	20.24 −35 +7	31					1 1
Red. for runs	19 19	20.31 − 5	20.26 +05 +1	27					3 3
Red. to hor. wire				20.30 ±.003					.0016
Red. to meridian	18 53		0 = 20.36 + 15						00032
Division error									±.008
Sum									
Pointer									
App. z									

log a'
A' log β
λ' log γ
log tang z
log r
r
z
$\phi - z = \delta$ (O)
δ (C)
δ (C − O)

Date Aug 6 1872 Observer Barom. = log B =

Att. Therm. = log T =

n Recorder Ex. Therm. = log β = log γ

	$19^h 49^m$	$19^h 49^m$	X X	$20^h 27^m$
Star.	b Aquarii	λ Ursae Min.	π Capricorni	ε Delphini
	+6° 6′	+88° 56′		+10° 53′
T_δ	19 49 11.7	19 49 54.2	20 20 9.4	20 27 16.0
T_m	13.7	50 48.0	11.5	18.1
T_e	15.7	51 45.9	13.7	20.2
T_f	20.0	52 39.0	18.1	24.4
T_g	22.0	53 34.0	20.2	26.4
T_h	24.1	54 28.3	22.4	28.6
Sum	26.2	55 26.4	24.6	30.6
Mean	28.3	56 19.2	26.7	32.7
Red. to T_m	32.4	57 13.0	31.1	36.9
Sum = s	34.4		33.3	39.0
$\frac{f}{s}(T_m - T_s)$	36.6		35.5	41.1
T	24.100 24.08	× 53 ~~33.~~22 34.333 32.39	22.41.409 22.39	28.58.545 28.54
RA	3.67	2.26	2.00	.8
RA — T	20.41	30.13	20.39	20.53
— n tang δ				
ΔT + m				

$T_m - T_\delta$									
A					n = -.20		h m		n
C	19 49	0 = 20.41 + 4		20.45 +.11 -.02		20.43	=19 53	0 = 30.13+3	13.16+58.18 =.18
Sum	20 20	20.39 - 1		20.35 -.34 + 07		45			
Mean	20 27	20.53 - 3		20.50 +.15 - 4		46			
Red. for runs						20.44			
Red. to hor. wire	20 12								
Red. to meridian									
Division error									
Sum									
Pointer		(dT+m) δ		T′ h m	Rate per hour = +1.24			n = -.22	
App. z		+19.65		13 44	~~+.43~~ +.11 +.47	20.12		-.23	
		20.04		17.14	~~+.11~~ +.04	08		-.25 -.26	
log a′		20.30		18 55	-.17	13		-.20 -.22	
A′ log β		20.44		20.12	-.34	10		-.18 1.56	
λ log γ				h m				n = -.223	
log tang z				17.31		20.11			
log r	b = +.21				n_1 =	+.48			
r	m = +.28 + .20 = +.48								
z					dT =	-20.59			
φ — z = δ (O)									
δ (C)									
δ (C — O)									

Time stars for Longitude

Date Aug 7 | Observer N.A.R. | Barom. = | log B =
n | Recorder | Att. Therm. = | log T =
| | Ex. Therm. = | log β = | log γ

Perhaps collimation set .11ˢ in error for these two stars.

Star.	Polaris	α Virginis	η Urs. Maj. 13ʰ 43ᵐ +49° 56′	η Bootis 13ʰ 49ᵐ +19° 2′	α Bootis 14ʰ 10ᵐ +19° 50′	ε Bootis		β Bootis 14ʰ 57ᵐ +40° 53′
T_δ	09 37.4	18 a 58.2	13 42 33.7	13 48 45.4	14 09 59.5	14 39 34.4	14 43 07.9	14 57 14.9
T_m	10 19.9	b 0.3	36.8	47.4	1.8	35.7	0.7	17.5
T_e	″ 3.6	c 2.5	39.9	49.8	3.9	38.0	2.9	20.3
T_f	″ 49.9		46.4	54.3	8.4	42.7	7.2	25.7
T_g	12 −28.8	2.8	49.6	56.3	10.5	45.0	9.3	28.4
T_h	12.3	2.8 2.9 25	52.9	58.4	12.8	47.4	11.5	31.2
Sum	56.3		55.9	0.7	14.9	49.7	13.6	33.9
Mean	~~37.8~~	+2.83 47.09	59.2	2.9	17.1	52.0	15.7	36.6
Red. to T_m	38.2		5.6	7.2	21.5	56.7	19.9	42.1
Sum = s	19.4		8.8	9.5	23.6	59.0	22.1	44.8
$\frac{1}{5}(T_m - T_s)$			12.0	11.6	25.8	1.3	24.2	47.4
T	29.54.533	49.92	52.800	58.500	12.71.709	47.36	~~16.26~~ 11.364	31.17.164
RA	30.17 18.48	49.90 27.54	52.69 29.99	58.48 85.98	12.69 50.03	47.34 24.63	~~16.35~~ ~~46.75~~	31.15 8.35
RA — T	11.69	22.36	22.70	22.50	22.66	22.71	~~22.40~~ 22.40	22.82
— n tang δ								
ΔT + m								

d ΔT = +.12

n = −.247

0 = +11.69 − 41.81 − 41.83

0 = 22.36 − .19 + 1.01 − .25

n = −.247

$T_m - T_\delta$				
A				
C				
Sum	13 42	0 = 22.70 + .07	22.77 +.19 − .29	22.57
Mean	13 48	22.50 + 6	22.56 + .34 − 8	48
Red. for runs	14 10	22.66 + 2	22.68 + 36 − 9	59
Red. to hor. wire	14 39	22.71 − 3	22.68 + 53 − 13	55
Red. to meridian	14 44	22.40 − 5	22.35 − 28 + 7	42
Division error	14 57	22.82 − 7	22.75 + .87 − 21	54
Sum				
Pointer	14 20			22.51
App. z				

log a′

A′ log β

λ′ log γ

log tang z

log r

r

z

ϕ — z = δ (O)

δ (C)

δ (C — O)

Date Aug 7
Observer
n
Recorder
Barom. =
Att. Therm. =
Ex. Therm. =
log B =
log T =
log β =
log γ

	16h 39m	16h 52m	XX	16h 59m	17h 9m	XX	17h 28m	17h 44m	17h 54m
Star.	η Herculis	κ Ophiuchi	d Herculis	ε Urs Min	α Herculis	44 Ophiuchi	β Draconis	ψ Draconis	g Draconis
	+39° 10'	+9° 34'		+82° 14'	+14° 32'		+52 24	+72° 13'	+51° 30'
T_δ	16 38 39.0	16 51 48.5	16 57 2.6	16 59 7.9	17 09 0.4	17 18 44.5	17 27 37.3	17 44 26.1	17 53 43.4
T_m	41.7	50.6	5.0	15.4	2.5	46.7	40.7	29.2	46.8
T_e	44.2	52.7	7.5	22.8	4.7	49.0	44.0	33.0	50.1
T_f	49.6	56.9	12.5	30.7	8.9	53.4	50.9	36.1	56.7
T_g	52.3	58.9	15.0	37.9	11.0	55.7	54.2	39.4	0.0
T_h	55.0	1.0	17.4	45.7	13.2	57.9	57.6	42.7	3.3
Sum	57.6	3.1	19.9	53.7	15.4	0.3	0.8	46.2	6.5
Mean	0.3	5.2	22.3	1.2	17.5	2.6	4.3	49.7	9.9
Red. to T_m	5.6	9.3	27.3	9.0	21.8	7.0	10.9	52.9	16.5
Sum = s	8.2	11.4	29.8		23.8	9.3	14.5		19.8
$\frac{1}{5}(T_m - T_s)$	10.9	13.6	32.3		25.9	11.6	17.7		23.2
T	5496.945	× 1.09.018	17.42.418	3826.255	13.19	58.00	57.54.536	39.48.478	3.29
RA	34.99 31.96	1.67 58.14	17.40 54.39	38.16 13.48	13.17 50.28	17.98 35.24	57.52 34.30	39.42 16.67	3.27 54.01
RA — T	22.99	22.88	23.01	24.68	22.89	22.74	23.22	23.73	23.26
— n tang δ									
ΔT + m									

adT = +.12s

n = −.247

$T_m - T_\delta$	o = 16 38	o = +22.97 + 14	+23.11 + 81 − 21	22.90	16 59	o = +24.68 + 7.34 − .24	3	9
A	16 51	+22.83 + 10	23.03 + .17 − 4	92	17 44	23.73 + 3.12 − .25	6	36
C	16 57	+23.01 + 9	23.10 + .67 − 17	93		− 245	0	0
Sum	17 09	+22.89 + 7	22.96 + .26 − 6	90		250	3	9
Mean	17 18	+22.74 + 5	22.79 − 45 + 11	90		495 .247	3	9
Red. for runs	17 27	+23.22 + 8	23.25 + .30 − 32	93			0	0
Red. to hor. wire	17 53	+23.26 − 2	23.24 + .26 − 31	93			0	0
Red. to meridian	17 57	+22.81 − 3	22.78 − 59 + 15	93			0	0
Division error	18 06	+22.86 − 5	22.81 − 39 + 10	91			2	4
Sum	18 32	+23.14 − 10	23.14 + .80 + 20	89			1	1
Pointer	18 45	+23.31 − 12	23.19 + 65 − 16	103			10	100
App. z	18 47	+22.94 − 13	22.81 − .50 + .12	93			0	0 .0159
log a'	17 42		23.01 + .33	22.93 ± .007				.00145
A' log β	14 20		2	22.51				±.026
λ log γ	dΔT =			.125				
log tang z								
log r	dT+m at 16h 01m	= −22.72		b = +.21		b = 28		
r	m	+ 50		m = 28 + 22 = +50		m = 29 + 23 = .52		
z	ΔT =	= −23.22						
φ — z = δ (O)								
δ (C)								
δ (C — O)								

Date Aug 7

n

Observer W. A. R.

Recorder

Barom. =
Att. Therm. =
Ex. Therm. =

log B =
log T =
log β =

log γ

	xx	xx	18h 13m	18h 33m		xx	xx
Star.	γ Sagittarii	μ Sagittarii	δ Urs. Min.	α Lyrae.		σ Sagittarii	50 Draconis
			+86° 36'	+38° 40'			
T_δ	17 57 45.9	18 06 18.4	18 13 6.2	18 32 45.8	18 45 31.8	18 47 31.1	18 50 45.0
T_m	48.4	20.5	22.3	16! 48.4	34.3	25 33.4	49.3
T_e	50.8	22.2	40.8	18.5 51.0	36.6	23 50 35.8	53.2
T_f	55.5	27.3	58.2	17.4 56.3	41.6	40.4	57.0
T_g	57.9	29.4	15.4	17.2 58.9	44.0	24 42.8	1.1
T_h	0.3	31.5	32.1	16.7 1.5	46.5	-25 45.0	5.3
Sum	2.6	33.8	50.4	18.3 4.2	49.0	25 47.3	9.4
Mean	5.0	36.0	7.7	17.3 6.8	51.4	24 49.7	13.2
Red. to T_m	9.7	40.3	25.7	18.4 12.1	56.4	50 54.3	29.3
Sum = s	12.3	~~42.7~~		14.7	58.9	25 56.5	37.4
$\frac{1}{5}(T_m - T_s)$	14.5	44.8		17.3	1.3	24 58.9	45.9
T	0.264	31.54.536	15.422	1.56 545	46.533	40 45.02.018	
RA	.25 37.44	31.52	15.14 48.28	1.58 38.24	46.51 23.20	45.00 22.06	
RA — T	22.81	8.66 22.86	26.86	23.24	23.31	22.94	
— n tang δ							
ΔT + m							
$T_m - T_\delta$							
A							
C							
Sum							
Mean							
Red. for runs							
Red. to hor. wire							
Red. to meridian							
Division error							
Sum							
Pointer							
App. z							
log a'							
A' log β							
λ log γ							
log tang z							
log r							
r							
z							
φ — z = δ (O)							
δ (C)							
δ (C — O)							

Date Aug 7/1872 Observer WAR. Barom. = log B =

n Recorder Att. Therm. = log T = log γ

Ex. Therm. = log β =

Observations with Coast Survey Transit.

Star.	xx κ Aquilae	19h 40m γ Aquilae +10° 19'	19h 45m α Aquilae +8° 32'	19h 49m ε Draconis +69° 57'	xx: α Capricorni	20h 13m κ Cephei +77° 20'	xx π Capricorni	20h 27m α Delphini +10° 53°	xx Groom. 3241	
T_δ	19 29 5.8	19 40 31.0	19 44 37.5	19 48 46.5	11 2.5	13 13.9	20 4.5	27 11.1	30 43.1	37 1.5
T_m	8.5	33.8	42.8	51 0.8	5.1	26.0	7.2	13.7	57.5	5.0
T_e	11.0	36.4	45.2	53 12.5	7.6	37.6	9.9	16.3	0.0	8.8
T_f	13.5	39.0	47.9	55 29.0	10.3	48.8	12.6	19.0	8.2	12.4
T_g	16.1	41.6	53.0	57 43.8	12.9	1.0	15.3	21.5	16.7	16.0
T_h	21.3		55.8		17.9		20.6	26.7		23.1
Sum	23.9		58.4		20.8		23.5	29.3		26.7
Mean	26.5		1.0		23.4		26.2	31.9		30.4
Red. to T_m	29.0		3.5		26.0		28.8	34.6		33.9
Sum = s	31.4		8.9		28.6		31.4	37.1		37.6
$\frac{1}{5}(T_m - T_s)$	36.7		11.3		33.9		36.8	42.4		44.9
T	39.4		13.9		36.4		39.5	45.0		48.4
RA	41.9		16.4		39.2		42.3	47.6		52.0
RA — T	44.5		19.0		41.7		45.0	50.2		55.6
— n tang δ	46.0				44.4		47.7	52.8		59.3
ΔT + m										
Mean 20	26.34	36.36	58.32	53 16.52	23.38	37.46	26.08	15.97	59.90	30.38
$T_m - T_\delta$	26.34	36.34	58.38	15.68	23.36	37.44	26.06	15.95	59.88	30.36
A	2.55	12.58	34.40	1.2	59.41	14.11	2.01	8.01	36.25	6.43
C	23.79	23.76	23.90	14.47	23.95	23.33	24.05	23.94	23.63	23.93

Sum

Mean c assumed = 0

Red. for runs dAT = +.12

Red. to hor. wire

Red. to meridian 19 29 0 = +23.79 + 1.07 + 23.86 − .13 − .02 + 23.84

Division error 19 40 23.76 + 5 81 + .18 + 2 83 l = +.03s

Sum 19 44 23.90 + 4 94 + 15 + 2 96 m = +4 − 11 = −.07

Pointer 20 11 23.95 − 1 94 − .23 − 3 91

App. z 20 20 24.05 − 4 101 − .34 − 4 97

20 27 23.94 − 5 86 + 19 + 2 88

log a' 20 37 23.93 − 7 86 + 1.01 + 13 99

A' log β

λ log γ −23.91 at 20h 4m

log tang z n −.07

log r 19 53 0 = +16.13 + 53.80 + .02 + 16.15 + .14 23.84 = Coast Survey Tr. } 20h 04m

r 20 13 23.33 + 1.44 − 2 + 23.31 + .14 23.74 = M. Circle

z 20 30 23.63 + 3.09 − 5 + 23.18 + .11

+.13

φ — z = δ (O)

δ (C)

δ (C — O)

Date Aug 8th 1872 Observer

Barom. =

Att. Therm. =

Ex. Therm. =

log B =

log T =

log β = ______

log γ

n

Recorder

N. H. R. obs. Time Stars for Long.

	16h 59m	17h 9m	XX	17h 28m	17h 29m	17h 42m	17h 44m	17h 54m	
Star.	ε Urs. Min.	α¹ Herculis	44 Ophiuchi	β Draconis	α Ophiuchi	μ Herculis	ψ¹ Draconis	γ Draconis	
	+82° 14'	+14° 32'		+52° 24'	+12° 39'	+27° 48'	+72° 13'	+51° 30'	
T_δ	16 59 11.2	17 09 3.5	17 18 47.4	17 27 40.4	17 29 14.7	17 41 40.7	17 44 29.3	17 53 46.0	
T_m	18.4	5.6	49.7	43.7	16.7	43.1	33.4	49.9	3.9
T_e	25.9	7.8	51.8	47.0	18.9	45.4	35.8	52.9	3.0
T_f	33.8	12.0	56.5	53.8	23.1	50.1	39.1	59.7	6.8
T_g	41.6	14.2	58.7	57.3	25.2	52.5	42.7	3.1	3.4
T_h	49.1	16.3	0.9	0.6	27.3	54.7	45.9	6.3	3.2
Sum	56.9	18.4	3.3	4.0	29.4	57.0	49.4	9.7	3.4
Mean	4.3	20.6	5.5	7.4	31.6	59.3	52.6	13.0	3.3
Red. to T_m	11.6	24.8	10.1	13.8	35.8	4.0	56.0	19.6	6.6
Sum = s		26.9	12.3	17.4	37.9	6.3		22.9	3.3
$\frac{1}{5}(T_m - T_s)$		29.0	14.6	20.7	39.9	8.8		26.3	3.4
T	41.422	16.282	1.000 0.982	0.56.555	27.327	54.72 718	4218 578	× 6.~~38~~ 309	
RA	41.15 13.41	16.26 50.27	0.98	0.54 34.27	27.30 1.31	54.70 28.65	42.50 15.63	6.39	
RA — T	27.74	25.99	35.23 25.75	26.27	25.99	26.05	.2689	3999 2650	
— n tang δ									
ΔT + m									
$T_m - T_\delta$									
A									
C									
Sum									
Mean									
Red. for runs									
Red. to hor. wire									
Red. to meridian									
Division error									
Sum									
Pointer									
App. z									
log a′									
A′ log β									
λ′ log γ									
log tang z									
log r									
r									
z									
φ — z = δ (O)									
δ (C)									
δ (C — O)									

Date Aug 8　　Observer　　Barom. =　　log B =

n　　Recorder　　Att. Therm. =　　log T = ______　　log γ

Ex. Therm. =　　log β =

Star.	×× ι Sagittarii	18h 33m α Lyrae +38°40′	×× 5, Ceph.	18h 45m β Lyrae +33°13′	×× ο Sagittarii	
T_δ	18 06 21.6	18 32 48.6	18 40	18 45 34.7	18 47 34.2	
T_m	23.5	57.3		37.2	36.5	2.3
T_e	25.6	53.9		39.6	38.8	2.3
T_f	30.2	59.2		44.5	43.4	4.6
T_g	32.4	1.8		47.0	45.7	2.3
T_h	34.5	4.5	13.7	49.5	48.1	2.4
Sum	36.8	7.1	36.2	51.9	50.3	2.2
Mean	39.0	9.8	57.6	54.4	52.6	2.3
Red. to T_m	43.4	15.1	18.7	59.3	57.1	4.5
Sum = s	45.6	17.6	53.5	1.7	59.5	2.4
$\frac{1}{5}(T_m - T_s)$	47.7	20.4	54.3 53.8	4.2	1.7	2.2
T	84.55	44.82	58.0 53.65	49.46.1455	× 46.88	~~48.~~ 47.58′
RA	84.53 8.65	4.46 38.23	53.98 81.79	49.44 23.19	~~46.87~~ 48.08	
RA — T	25.88	26.23	22.19	26.25	25.99	
— n tang δ						
ΔT + m						

ΔT=+10

n = −.220

$T_m - T_\delta$						
A	17 09	● = + 25.99 +05 +8	+ 26.07 +26 −05	26.02	3	
C	17 18	25.75 +3 +6	25.81 −45 +.10	25.91	8	
Sum	17 27	26.27 +2 +5	26.22 +1.30 −29	26.09	4	
Mean	17 28	25.99 +9 +5	26.04 +22 −05	25.99	0	
Red. for runs	17 41	26.05 −11 +2	26.07 +53 −12	25.95	4	
Red. to hor. wire	17 53	26.38 −13 +0	26.33 +1.26 −27	26.06	7	
Red. to meridian	18 05	25.88 −5 −2	25.86 −39 +9	25.95	4	
Division error	18 02	26.23 −9 −4	26.19 +80 −18	26.01	2	
Sum	18 45	26.25 −11 −12	26.12 +65 −14	25.98	1	
Pointer	18 46	26.69 −11 −50	25.80 +50 −14	25.98	1	
App. z						
	17 55		26.07 +.43	25.99		
log a′				+52		
A′ log β				−26.51 at 17h 55m		
λ log γ	16 59	o = +27.74 +.09	+ 27.83 +7.34 −26			b = +.24
log tang z	17 44	26.89 +2	26.91 +3.12 21			m = +.32 + 20 = +.52
log r	18 39	22.19 −7	22.12 −20.83 −19			
r			66			
z			−220			m = 29 + 20 = .49
φ — z = δ (O)						
δ (C)						
δ (C — O)						

Date Aug 9th 1872 Observer

n Recorder

Barom. =
Att. Therm. =
Ex. Therm. =

log B =
log T =
log β =

log γ

	XX	XX	13h 43m	13h 49m	14h 10m	14h 21m	XX	15h 29m
Star.	Polaris	α Virginis	η Ursae Maj.	η Bootis	α Bootis	θ Bootis	ε Bootis	α Coronae
			+49° 56'	+19° 2	+19° 50'	+52° 26'		+27° 8'
T_δ	13 09 42.9	13 18 42.9	13 42 39.1	13 48 51.0	14 10 5.1	14 20 59.0	14 39 48.2	15 29 31.6
T_m	〃 26.9	45.0	42.4	53.2	7.2	2.4	34 49.4	33.9
T_e	〃 11.2	47.0	45.5	55.4	9.5	5.7	33 50.5	36.2
T_f	〃 54.0	51.2	52.0	59.7	13.9	12.6	6.9 51.7	40.9
T_g	〃 37.3	53.3	55.1	1.9	15.9	15.9	1.3 52.9	43.2
T_h	20.0	55.4	58.4	4.2	18.2	19.3	54.1	45.5
Sum	2.1	57.5	1.5	6.2	20.4	22.6	55.2	47.9
Mean	44.7	59.6	4.8	8.4	22.6	26.1	56.3	50.1
Red. to T_m	29.2	3.8	11.2	12.7	26.9	32.9	57.5	54.8
Sum = s		5.8	14.3	15.0	29.1	36.2		57.0
$\frac{1}{5}(T_m - T_s)$		7.9	17.4	17.0	31.3	39.5		59.4
T	36.48.478	55.400	58.34.336	4,064	× 18.19 191	× 19.29 ~~473~~ .291	× 54.17 52.867	45.500
RA	37.11 20.06	58.38 27.52	58.32 29.95	4.04 35.99	18.16 49.98	19.27 50.83	54.15 52.85 24.59 2459	45.48 17.16
RA — T	17.05	27.86	28.37	28.10	28.18	28.44	~~28.16~~ 28.26	28.32
— n tang δ								
ΔT ± m								

4dT = +.18

$T_m - T_\delta$				n = −.220	
A	13 18	0 = +27.86 +.17	+ 28.03 −.19 +.04	~~28.07 0 = +17.05 +.18 +17.23~~	
C	13 42	28.37 +13	28.50 +1.19 −26	28.24	
Sum	13 48	28.10 +12	28.22 +.34 −7	28.15	
Mean	14 10	28.18 +8	28.26 +.36 −8	28.18	
Red. for runs	14 20	28.44 +7	28.51 +1.30 −29	28.22	
Red. to hor. wire	14 39	28.26 +4	28.30 +53 −12	28.18	
Red. to meridian	15 29	28.82 −5	28.27 +.51 −11	28.16	
Division error	15 44	28.14 −7	28.07 +09 −2	28.05	
Sum	15 57	28.19 −9	28.10 −.35 +8	28.18	
Pointer	16 15	28.46 −11	28.35 +1.06 −23	28.12	b = +.25
App. z	16 21	28.03 −13	27.89 −.49 +11	28.01	m = .34 +.20 = +.54
	16 22	28.68 −16	28.52 +1.86 −.41	28.11	
log a'					
A' log β	15 00			28.14	
λ log γ				+.54	
log tang z				28.68 at 15h 0m	
log r	13 12	0 = 17.05 —	−41.81	ΔT between Aug 8 & 9 = +.091	
r					
z					
$\phi - z = \delta$ (O)					
δ (C)					
δ (C — O)					

Date	Observer	Barom. =	log B =
		Att. Therm. =	log T =
n	Recorder	Ex. Therm. =	log β =

log γ

	15h 45m	x x	16h 16m	x x	16h 22m
Star.	ε Serpentis	β Scorpii	τ Herculis	α Scorpii	η Draconis
	+4° 51'		+46° 37'		+61° 48'
T_δ	15 44 43.2	15 58 25.9	16 16 5.0	16 20 49.6	16 22 37.1
T_m	45.2	27.2	8.4	51.9	39.3
T_e	47.3	28.2	11.4	54.2	41.4
T_f	51.4	29.3	17.4	58.7	43.6
T_g	53.5	30.4	20.5	1.1	45.7
T_h	55.6	31.5	23.4	3.4	48.0
Sum	57.6	32.6	26.4	5.6	50.2
Mean	59.7	33.6	29.4	7.9	52.3
Red. to T_m	3.8	34.6	35.4	12.5	54.5
Sum = s	5.9		38.5	14.9	
$\frac{1}{5}(T_m - T_s)$	7.9		41.4	17.1	
T	55.56 .555 55.54	30.37 .367 30.35	23.382 23.36	3.36 .355 3.38	45.79 .789 45.77
RA	27.46	1.16	54.90	25.21	17.09
RA — T	28.14	28.19	28.46	28.03	28.68
— n tang δ					
ΔT + m					
$T_m - T_\delta$					
A					
C					
Sum					
Mean					
Red. for runs					
Red. to hor. wire					
Red. to meridian					
Division error					
Sum					
Pointer					
App. z					
log a'					
A' log β					
λ log γ					
log tang z					
log r					
r					
z					
φ — z = δ (O)					
δ (C)					
δ (C — O)					

Date Aug 10 Observer W.A.R. Barom. = log B =

Att. Therm. = log T =

n Recorder Ex. Therm. = log β = log γ

W.A.R. observes for time.

Star.	16h 39m η Herculis +39°10'			16h 52m κ Ophiuchi +9°34'	× × d Herculis	16h 59m ε Urs Min +82°14'		17h 9m α Herculis +14 32
T_δ	16 38 46.9	43 2.2	46 34.7	51 56.4	57 10.4	58 14.6	17 03 52.5	09 8.3
T_m	49.5	5.9	36.7	58.4	12.8	30.0	53.3	10.5
T_e	52.2	9.8	38.9	0.5	15.4	44.9	57.9	12.6
T_f	57.5	17.3	43.1	4.6	20.4	01 17.7	3.4	16.8
T_g	0.0	21.0	45.3	6.8	22.8	03 52.5	6.1	19.0 21.0
T_h	2.8	24.8	47.4	8.8	25.3	55.3	8.8	23.2
Sum	5.3	28.6	49.6	11.0	27.7	57.	11.4	25.3
Mean	8.2	32.5	51.7	13.0	30.2		14.2	29.5
Red. to T_m	13.5	40.0	56.0	17.1	35.2		19.6	31.6
Sum = s	16.1	43.7	58.1	19.2	37.7		22.3	33.8
$\frac{1}{5}(T_m - T_s)$	18.8	47.6	0.2	21.3	40.0		25.0	
T	2.800	24.86 855	47.43.427	8.83 827	25.27.264		8.773	21.06 .055
RA	2.78 31.90	24.84	47.41	8.81 38.10	25.25 54.34		8.75	21.01 30.25
RA — T	30.88			30.71	30.91			30.79
— n tang δ								
ΔT + m								

Δd T = +.10 n = -.30

$T_m - T_\delta$	16 38	0 = +30.88	+10	+30.98 +.81	-.24	30.74	3	9
A	16 51	30.71	+ 8	30.79 +.17	- 5	74	3	9
C	16 57	30.91	+7	30.98 +.67	-20	78	1	1
Sum	17 10	30.79	+ 5	30.84 +.26	- 8	76	1	1
Mean	17 18	30.55	+21	30.59 -.45	+14	73	4	16
Red. for runs	17 27	31.08	+2	31.10 +1.30	-39	71	6	36
Red. to hor. wire	17 28	30.80	+2	30.82 +.22	- 7	75	2	4
Red. to meridian	17 41	31.00	-1	30.99 +.53	-16	83	6	36
Division error	17 53	31.21	-3	31.18 +1.26	-38	80	3	9
Sum	18 06	60.69	- 5	30.64 -.39	+12	76	1	1
Pointer	18 28	30.76	- 8	30.68 -.15	+ 4	72	5	25 +.031
App. z	18 32	31.15	- 9	31.06 +.80	-.24	82	5	25
	18 45	31.16	-11	31.05 +.65	-.19	86	9	81
log a'						30.77 ±.006		.0253
A' log β	17 38			30.90 +.44		56		.0021
λ log γ						31.33 at 17 38		
log tang z								
log r					n			
r	17 44	31.75	+ 1	31.76 +3.12	-.32			
z	18 12	35.37	- 6	35.31 +16.83	+.27			
φ — z = δ (O)								
δ (C)								
δ (C — O)								

b = +.22

m = +.29 +.27 = +.06

Date
n

Observer
Recorder

Barom. =
Att. Therm. =
Ex. Therm. =

log B =
log T =
log β =

log γ

	××	17h 28m	17h 29m	17h 42m		17h 44m	17h 54m	××	18h 13m	××.	
Star.	44 Ophiuchi	β Draconis	α Ophiuchi	μ Herculis		ψ Draconis	γ Draconis	μ Sagittarii	δ Ursae Minoris	ι Cygni	
		+52°24'	+12°39	+27°48		+72°13	+51°30'		+86°36'		
T_δ	17 18 52.3	24 45.1	28 19.5	41 45.7		44 33.8	53 51.3	18 56 26.1	13 14.2	28 34.8	
T_m	54.6	48.6	21.6	48.0	23	37.1	54.6	28.3	30.5	37.0	2.2
T_e	56.8	51.9	23.6	50.3	23	40.5	57.8	30.5	47.6	39.0	2.0
T_f	1.2	58.6	27.8	55.0	47	43.8	4.5	34.9	6.1	43.1	4.1
T_g	3.4	1.8	30.0	57.3	23	47.1	7.7	37.0	23.1	45.2	2.1
T_h	5.8	5.2	32.1	59.6	23	50.7	11.0	39.4	41.3	47.3	2.1
Sum	8.1	8.7	34.2	2.0	2.4	54.0	14.5	41.6	57.4	49.1	1.8
Mean	10.3	12.1	36.3	4.3	23 46	57.3	17.7	43.7	15.6	51.6	2.5
Red. to T_m	14.8	18.8	40.6	8.9	2.4	1.6	24.3	48.2	31.5	55.7	4.1
Sum = s	17.0	22.1	42.7	11.3	23		27.6	50.4		57.6	1.9
$\frac{1}{5}(T_m - T_s)$	19.3	25.5	44.8	13.6			30.9	52.6		59.8	2.2
T	6.782	5.81.809	32.11.109	59.64.636		47.322	11.082	39.34.336	2.3.033	× 47.83.249	
RA	5.76 19 35.21	5.30 34.22	32.09 1.29	59.62 28.62		47.26 15.57	11.06 39.85	39.32 8.63	22.76 47.39	47.31 16.55	
RA − T	30.55	31.08	30.80	31.00		81.75	31.21	30.69	35.37	30.76	
− n tang δ											
ΔT + m											
$T_m - T_\delta$											
A											
C											
Sum											
Mean											
Red. for runs											
Red. to hor. wire											
Red. to meridian											
Division error											
Sum											
Pointer											
App. z											
log a'											
A' log β											
λ log γ											
log tang z											
log r											
r											
z											
φ − z = δ (O)											
δ (C)											
δ (C − O)											

Date Aug 10

n

Observer

Recorder

Barom. =

Att. Therm. =

Ex. Therm. =

log B =

log T =

log β =

log γ

Star.	18h 33m α Lyrae .		, 18h 45m β Lyrae	
		+38°40'		+33°13'
T_δ	18 32	33.5	45	39.6
T_m		56.2		42.1
T_e		58.8		44.6
T_f		4.1		49.3
T_g		6.8		51.9
T_h		9.4		54.3
Sum		11.9		56.8
Mean		14.7		59.3
Red. to T_m		19.9		4.2
Sum = s		22.6		6.6
$\frac{1}{5}(T_m - T_s)$		25.1		9.0
T		4.364	×	54.345 336
RA		9.35 38.20		54.33 23.17
RA — T		31.15		31.16
— n tang δ				
ΔT ∓ m				
$T_m - T_\delta$				
A				
C				
Sum				
Mean				
Red. for runs				
Red. to hor. wire				
Red. to meridian				
Division error				
Sum				
Pointer				
App. z				
log a'				
A' log β				
λ log γ				
log tang z				
log r				
r				
z				
φ — z = δ (O)				
δ (C)				
δ (C — O)				

Date Observer Barom. = log B =

Att. Therm. = log T =

n Recorder Ex. Therm. = log β = log γ

Star. Approximate results for Longitude of St. Pierre.

	b	Date	Time	ΔT	n		b	m	Daily rate	Hourly rate	Rogers ΔT 14.0h	Smith ΔT 14.0h	Diff
Tδ													
Tm													−.04
Te	.37	July 20	17h 50m	−5.06 5.15	−.310s		+.32s	+.71	+0.14		−5.06 15	5.02	+.02s +04 −13
Tf	.37	21	20 52	4.77 4.77	−310	.37s	+40	+.82	+.14		4.77 79	4.81	−14 +02 +02
Tg	37	22	17 36	4.78 4.77	−276		+.38	+.77	+.11		4.78 78	4.64	−9 −14 −13
Th	.38	23	16 39	4.53 4.53	−270		±.38	+.76	+.28		4.51 53	4.42	−5 −9 −11
Sum	38	24	16 56	4.21 4.22	253		+.37	+.73	+.16		4.20 21	4.15	−7 −5 −6
Mean	38	25	16 59	4.19 4.17	258	.38	+.38	+.74	+.08		4.19 17	4.12	−10 −7 −5
Red. to Tm	38	27	17 50	4.03 3.99	231		+.38	+.72	+.21		4.03 3.98	3.93	−13 −14 −6
Sum = s	38	28	16 49	3.77 3.62	210		+.44	+.78	−.01		3.77 62	3.63	−16 −13 +1
1/6 (Tm − Tδ)	38	29	17 07	4.07 3.88	204	.33	+.46	+.81	−.57	−.024	4.09 3.90	3.93	+08 −16 +3
T	36	30	17 49	4.95 5.02	282		+.26	+.60	−1.52	.063	4.96 5.03	5.04	+.03 +08 +1
RA	35	Aug 1	16 43	7.93 7.96	260		+.18	+.48	−2.52	.105	8.12 8.10	8.15	+43 +03 +5
RA − T	33	4	15 44	15.18 15.30	.180		+.17	+.40	−2.54	.106	15.47 .54	15.90	+.33 +43 +.36
— n tang δ	32	5	17 24	17.89			+.17	+.40	−2.52	.105	17.96	18.29	+19 +33
ΔT + m		6	17 31	20.59 20.60	.223		+.21	+.48	−2.61	.109	20.64 20.65	20.83	+27 +19 +18
		7	17 42	23.43 23.45	247		+.21	+.50	−2.72	.114	23.46 .48	23.73	+.21 +27 +25
Tm − Tδ		8	17 58	26.51 26.48	220	.26	+.24	+.52	−2.93	.122	26.52 49	26.73	+21 +23
A		9	15 00	28.68 28.63	220		+.25	+.54	−2.70	.113	29.02 .97	29.22	+20 +20 +25
C		10	17 38	31.33 31.33	302		+.22	+.56	−2.34	.098	31.17 07	31.54	+37 +37 +40
Sum					Mean −.25		+.32	+.63					

Mean

Red. for runs

Red. to hor. wire

Red. to meridian

Division error

Sum

Pointer

App. z

The mean of the first ten dates gives R *less* than S, .07s a = +.60s

The mean of the last nine dates gives R *greater* than S, .23s

The difference of longitude between the two stations = about .07s by measurement

Applying this correction,

On the first ten nights Smith observed .14s earlier than Rogers

On the last nine nights Smith observed .20 later than Rogers.

Resulting Longitudes.

July 21	Rogers = 46.74	67		Smith = 46.77	70		
22	82	82		67	67		
23	55	65		46	56		
28	82	82	46.73 .74	75	75	46.66	46.67
29	61	60		63	62		
Aug 1	61	61		55	55		
6	47	46		66	65		
9	48	49	46.54 .54	60	61	46.61	46.61
	46.64			46.64			

log a'

A' log β

λ log γ

log tang z

log r

r

z

φ − z = δ (O)

δ (C)

δ (C − O)

For the last four dates Smith = 46.61 − 07 = 46.54 Rogers = 46.54

Date Aug 14 | Observer | Barom. = | log B =
n | Recorder | Att. Therm. = | log T = | log γ
 | | Ex. Therm. = | log β =

Star.	h					$+2^s$			
T_δ	0 02 19.4	07 21.3	32 41.0	09 33.1	17 11.8	24 10.2			
T_m	21.9	23.6	44.7	10 17.4	13.9	12.9			
T_e	24.1	25.9	48.5	10 59.5	15.9	14.6			
T_f	28.8	27.8	55.7	11 39.0	20.0	18.6			
T_g	31.1	29.9	59.3	12 24.3	22.1	20.8			
T_h	33.5		2.8	13 7.3	24.3	22.9			
Sum	35.9		6.8	13 51.0	26.3	25.2			
Mean	38.1		10.5	14 32.5	28.5	27.3			
Red. to T_m	43.0		17.8	15 15.0	32.6	31.6			
Sum = s	45.2		21.5		34.7	33.7			
$\frac{1}{5}(T_m - T_s)$	47.5		25.3		36.8	35.9			
T	3350	2572	3.08	2435	2427	23.02			
RA	33.48 48.48	25.70 40.74	3.06 17.70	23.72 24.59	24.25 39.24	23.00 39.77			
RA − T	45.00	44.96	45.36	59.13	45.01	45.23			
− n tang δ									
ΔT + m									

$T_m - T_\delta$		4dT = .13	
A			
C			n
Sum	0 02	0 = 45.00 +09 45.09 +54 −09 45.00	1.12 o = 59.13 + 41.83 = −34
Mean	0 17	44.96 + 5 45.01 + 26 − 8 44.93	
Red. for runs	0 32	45.36 + 3 45.39 +1.47 − 50 44.89	
Red. to hor. wire	1 17	45.01 − 8 44.93 − 16 + 05 44.98	
Red. to meridian	1 24	45.23 − 9 45.14 + 26 − 8 45.06	
Division error			
Sum	0 42	45.11 + .47 44.97	b = +.24
Pointer		+63	m = +32 + 81 = +63
App. z		dT = 45.60	
log a′			
A′ log β			
λ log γ			
log tang z			
log r			
r			
z			
φ − z = δ (O)			
δ (C)			
δ (C − O)			

Date Sept. 9 /72 Observer W.A.R.
n Recorder

Barom. =
Att. Therm. =
Ex. Therm. =

log B =
log T =
log β =
log γ

W. A. R. Obs. for personal Equation between single and double wires

Star. α Aquilae = λ Urs Min

T_δ	d = double	s = single	d	d	d	s	d	d	s
T_m	19 44 31.8		19 57 50.7	20 19 57.1	20 27 3.4	26 48.6	20 36 58.6	20 45 42.7	45 28.0
T_e	33.8		53.1	59.3	5.4	50.7	1.1	44.8	30.0
T_f	36.0	51 1.1	55.0	1.4	7.7	52.8	4.6	47.0	32.2
T_g	38.2	52 50.8	57.0	3.6	9.8	54.9	7.4	49.1	34.3
T_h	40.3	54 40.2	59.1	5.8	11.8	57.1	10.4	51.2	36.4
Sum	42.3		1.0	8.0	13.9	26.7	13.5	53.3	5.8
Mean	44.3		3.3	10.3	16.0	28.7	16.2	55.3	8.0
Red. to T_m			5.3	12.4	18.1	31.0	19.0	57.4	10.2
Sum = s			7.5	14.5	20.3	33.2	27.0	59.5	12.2
$\frac{1}{5}(T_m - T_s)$						35.2			14.4
T	38.10	52 50.90	59.11	5.82	11.82	11.89	10.03	51.14	51.15
RA	38.05 34.18	50.88 32.91	59.09 55.18	5.80 1.95	11.80 7.89	11.87 7.89	10.31 6.12	51.12 47.30	51.13 47.30
RA — T E.R.H	+3.92	~~+0.88~~ +17.18	+3.91	+3.85	+3.91	+3.98	+4.19	+3.82	+3.83
— n tang δ									
ΔT + m									

				Hourly rate assumed = +.08					
$T_m - T_\delta$									
A			Time from double wires.						
C					n = −25			b = +22	
Sum		19 44	c = +3.92	+15 −04	3.88	3.88 +06	2 4 3.82	m = +29 +19	= +.48 6 36
Mean		19 57	3.91	+12 −03	88	88 +05	2 4 3.83	dT m	= −3.00 5 25
Red. for runs		20 19	3.85	−34 +08	93	93 +03	3 9 3.90	dT	= −4.38 2 4
Red. to hor. wire		20 27	3.91	+19 −05	86	86 +03	4 16 3.83		5 25
Red. to meridian		20 36	4.19	+01 −25	94	94 +02	4 16 3.92		4 16
Division error		20 45	3.82	−17 +04	86	86 −01	4 16 3.85		3 9
Sum		21 01	4.13	−78 +19	94	94 +00	4 16 3.94		6 36
Pointer		21 7	3.99	+57 −14	85	85 +01	5 25 3.86		2 4
App. z		21 24	3.93	−11 +03	96	96 +02	6 36 3.98		10 100
		21 30	4.08	−15 +04	(104)	+03			2 4
log a′		21 37	3.91	+17 −04	87	87 +03	3 9 3.90		
A′ log β		~~21 39~~	3.68						
λ log γ		21 46	3.84	−25 +05	89	89 +04	±.028 3.93		±.036
log tang z		20 58	3.96	+16		3.90.	3.89		
log r					w				
r		19 52	+50.18	+52.82	−25				
z		(21 15	4.49	+1.88	31)				
φ — z = δ (O)		21 26	4.60	+2.75	−25				
δ (C)		21 39	4.68	+2.16	26				
δ (C — O)					.253				

Date Sep. 9 1872 Observer J.A.R.
n Recorder

Barom. =
Att. Therm. =
Ex. Therm. =

log B =
log T =
log β =

log γ

Star.								
T_δ	d	d	d	S	d	S	d	S
T_m	21h 1m 5.7	21 7 25.7	21 19 20.4	21 14 49.8	21 24 47.1	24 32.6	21 26 43.7	
T_e	8.3	28.4	25.1	54.4	49.2	34.6	49.7	
T_f	10.9	30.8	29.6	58.6	51.3	36.7	55.6	
T_g	13.5	33.1	33.9	3.1	53.4	38.7	1.8	26 18.9
T_h	16.2	35.4	38.6	7.4	55.4	40.9	7.8	25.1
Sum	18.6	37.8	42.8	9.4	57.5	9.9	13.8	50.4
Mean	21.4	40.3	47.3	13.7	59.6	12.1	18.6	56.4
Red. to T_m	23.9	42.6	51.5	18.2	1.7	14.2	25.6	
Sum = s	36.7	45.1	56.0	22.6	3.8	16.3	31.9	
$\frac{1}{5}(T_m - T_s)$				27.1		18.4		
T	16.14	35.47	38.35	38.43	55.44	55.44	7.72	7.70
RA	16.12	35.45	38.32	35.47	55.42	55.42	7.67	7.65
RA — T	11.99	31.46	33.83	33.83	51.99	51.49	3.07	3.07
— n tang δ	4.13	3.98	4.49	4.58	3.93	3.93	4.60	4.58
ΔT + m								
$T_m - T_\delta$								
A								
C								
Sum								
Mean								
Red. for runs								
Red. to hor. wire								
Red. to meridian								
Division error								
Sum								
Pointer								
App. z								
log a′								
A′ log β								
λ log γ								
log tang z								
log r								
r								
z								
ϕ — z = δ (O)								
δ (C)								
δ (C — O)								

Date Sep. 9 1872 Observer W.A.R.

n

Recorder

Barom. =
Att. Therm. =
Ex. Therm. =

log B =
log T =
log β =

log γ

Star.

T_δ	d	s	d	s	d	s	d	d	s
T_m	21 20 54.3	30 39.6	37 52.0	37 37.0	21 39 45.3	21 46 16.8	46 1.8		
T_e	56.4	41.7	54.0	39.1	57.5	19.0	3.9		
T_f	58.6	43.7	56.0	41.2	57.8	21.1	6.1		
T_g	0.6	45.7	58.0	43.4	4.1	23.4	8.1		
T_h	2.7	47.8	0.1	45.5	10.2	25.4	10.3		
Sum	4.7	17.3	2.3	14.9	16.5	27.4	40.4		
Mean	6.8	19.4	4.3	17.0	22.9	29.6	42.3		
Red. to T_m	8.8	21.5	6.4	18.8	59.2	31.7	44.5		
Sum = s	10.8	23.6	8.5	21.2	35.4	34.0	46.7		
$\frac{1}{5}(T_m - T_s)$	.9	25.7		23.3			48.7		
T	2.62	2.60	0.18	.14	10.22		21.28		
RA	2.61 58.59	2.58 58.59	.16 56.25	.12 56.25	10.27 5.59		21.26 21.52		
RA − T	4.02	3.98	3.91	3.87	4.68		3.74		
− n tang δ									
ΔT + m						hourly rate	assumed = $-.0^s5$		

Time from single wires

			h m						
$T_m - T_\delta$			20 26	0 = 3.88	+.19 −05	+3.93 −04	3.89		
A			20 45	3.83	−17 +04	3.87 −.03	3.84		
C			21 14	4.58	+1.18 −.47	4.01 .00	4.01		
Sum			21 29	3.93	−.11 +03	3.96 + 00	3.96		
Mean			21 27	4.58	+2.75 −68	3.89 + 01	3.90		
Red. for runs			21 30	3.99	−.15 +04	4.03 + 01	4.04		
Red. to hor. wire			21 38	3.87	+.17 −04	3.83 +02	3.85		
Red. to meridian			21 46	3.74	−.25 +05	3.79 + 03	3.82		
Division error			21 16			3.91	3.91		
Sum									
Pointer									
App. z									
log a′									
A′ log β									
λ′ log γ									
log tang z									
log r									
r									
z									
φ − z = δ (O)									
δ (C)									
δ (C − O)									

Date Sept. 10 1872 Observer W.A.R. Barom. = log B =
Att. Therm. = log T = log γ
n Recorder W. H. Ex. Therm. = log β =

1st obs. = W.A.R. 2nd obs. = W. H. R obs. with 9 wires. H obs. with 10 wires

Star.	ζ Aquilae 19h 0m +13° 41'	N	ι Lyrae 19h 3m +35° 54' R	N 2C	d Sagittarii ×× R	N	δ Draconis 19h 13m R +67° 26'	N
T_δ	18 59 27.6	59 12.6	19 02 38.2	2 20.2	19 10 4.6	9. 49.3	19 12 14.2	11 35.6
T_m	29.7	14.7	40.7	22.7	6.7	51.5	19.7	41.3
T_e	31.9	16.7	43.3	25.4	8.9	53.6	24.9	46.3
T_f	34.0	18.9	45.8	27.8	11.2	55.9	29.9	51.7
T_g	36.0	21.1	48.4	30.3	13.5	58.0	35.6	57.3
T_h	38.0	[illegible].0	50.8	6.2	15.7	28.8	40.8	13.4
Sum	40.3	53.1	53.5	8.7	17.8	30.9	46.3	18.7
Mean	42.4	53.3	56.0	11.4	20.1	33.2	51.7	24.2
Red. to T_m	44.5	57.3	58.5	14.0	22.3	35.4	57.3	29.6
Sum = s		59.5		16.6		87.6		35.0
$\frac{1}{5}(T_m - T_s)$	59 36.044	59 36.02	02 48.316	02 48.330	10.13.422	10 13.420	12 35.600	12 35.[illegible]31
T	36.02	36.00	48.32	48.31	13.40	13.41	35.56	35.37
RA	59 33.25	33.25	45.59	45.59	10.76	10.76	32.58	32.58
RA — T	2.77	2.75	2.73	2.72	2.64	2.65	2.98	2.77
— n tang δ								

ΔT + m Time from observations of W.A.R. ΔT+m from obs. of W.H. but with n = −.12s

Hourly rate assumed = −.05s n = −.12

	h	m					n									
$T_m - T_\delta$	19	0	○ = +2.77s	−04	+2.73s	+34		−04	+2.69	1	1	2.71	−04	+2.67	2	4
A	19	2	2.73	−03	2.70	+32		+09	.[illegible]	7	49	2.69	−09	.60	5	25
C	19	10	2.64	−03	2.61	−35		+04	65	3	9	2.62	+04	66	1	1
Sum	19	25	2.81	−01	2.80	+.52		+06	74	6	36	2.75	−06	69	4	16
Mean	19	29	2.69	−01	2.68	+.13		+02	70	2	4	2.69	+02	71	6	36
Red. for runs	19	32	2.78	−01	2.77	+1.19		−14	63	5	25	2.73	−14	59	6	36
Red. to hor. wire	19	40	2.65	+00	2.65	+.18		−.02	63	5	25	2.69	−02	67	2	4
Red. to meridian	19	44	2.71	+00	2.71	+.15		−02	69	1	1	2.66	−02	64	1	1
Division error	20	04	2.68	+02	2.70	−02		+00	70	2	4	2.69	+00	69	4	16
Sum	20	18	2.80	+03	2.83	+83		−10	73	5	25	2.72	−10	62	3	9
Pointer	20	42	2.59	+03	2.62	−34		+04	66	2	4	2.56	+04	.60	5	25
App. z	20	27	2.70	+02	2.74	+19		−02	72	4	16	2.69	−02	67		±.028
Mean	19	41	2.71		2.71	+27		−03	2.68 ±.008		±.028			2.65 ±.008		
log a'																
A' log β	19	12	2.98	−.02	2.96	+2.41	−.12	−.29	+2.70	2	4					
λ log γ	19	18	3.14	−02	3.12	+3.29	−.13	−40	.72	4	16					
log tang z	19	48	2.84	+01	2.85	+2.74	−.06	−32	.53	15	225					
log r	20	13	3.23	+02	3.25	+4.44	−.13	−53	72	4	16 ±.056					
r	20	30	3.07	+04	3.11	+3.40	.14	−37	.74	4	16					
z							−.12		2.68							

φ — z = δ (O) b = +.17 b = +.17

δ (C) m = .23 + 11 = +.34 m = +.23 + .11 = +.34

δ (C — O) dT+m = −2.68 dT+m −2.65

dT = −3.02 at 19h 41m Daily rate = −.123s dT — = −2.99

Date Sept. 10 1872
Observer W. R.
Recorder W. H.
n

Barom. =
Att. Therm. =
Ex. Therm. =

log B =
log T =
log β =
log γ

Star.	$19^h 18^m$ τ Draconis		$19^h 26^m$ β Cygni		κ Aquilae		$19^h 33^m$ θ Cygni	
	+73° 7′ R	H	+27° 42′ R	H	H	R	+49° 56′ R	H
T_δ	19 17 36.4	16 46.0	19 25 28.7	25 12.3	19 29 42.2	29 56.7	19 32 52.0	32 29.5
T_m	43.6	58.7	31.1	14.6	44.2	58.8	55.3	32.7
T_e	50.7	0.4	33.5	1.5	46.3	0.8	55.5	35.8
T_f	57.7	7.9	85.7	3.7	48.4	2.9	1.7	39.1
T_g	4.7	14.6	38.0		50.4	5.0	4.9	42.4
T_h	11.6	54.6	40.4		19.6	7.2	8.1	27.4
Sum	18.8	1.7	42.7		21.8	9.2	11.4	30.6
Mean	26.1	8.8	45.2		23.4	11.3	14.5	33.8
Red. to T_m	33.3	16.0	47.4		25.9	13.4	17.8	37.1
Sum = s		23.1			28.0			40.3
$\frac{1}{s}(T_m - T_s)$	18 477.767	18 4.68	25 38.08078	25 38.033	30 5.020	30 5.0333	33 4.911	33 4.170
T	4.72	4.63	38.06	38.01	5.01	5.02	4.89	4.15
RA	1.58	1.58	35.25	35.25	2.31	2.31	2.11	2.11
RA − T	3.14	3.05	2.81	2.76	2.69	2.70	2.78	2.74
− n tang δ								
ΔT + m								

Time from observations of W. H.

n = −.07

								R − H
$T_m - T_\delta$		0 = +2.75 −.04	+2.71 +.34 −.02	2.69	3	9		$+.02^{5}$
A		2.72 −.03	2.69 +.72 −.05	64	2	4		+.02
C		2.65 −.03	2.62 −.35 +.02	64	2	4		−.01
Sum		2.76 −.01	2.75 +.52 −.04	71	5	25		+.05
Mean		2.70 −.01	2.69 +.13 −.01	68	2	4		−.01
Red. for runs		2.74 −.01	2.73 +1.19 −.08	65	1	1		+.04
Red. to hor. wire		2.69 +.00	2.69 +.18 −.01	68	2	4		−.04
Red. to meridian		2.66 +.00	2.66 +.15 −.01	65	1	1		+.05
Division error		2.67 +.02	2.69 −.02 +.00	69	3	9		+.01
Sum		2.69 +.03	2.72 +.83 −.06	66	0	0		+.11
Pointer		2.53 +.03	2.56 −.34 +.2	58	8	64	±.022	+.06
App. z		2.65 +.07	2.69 +.19 −.1	68	2	4		+.05
	19 41		2.68 +.27	2.66 ±.006				+.41 −.06 = +.35
log a′								R − H Mean = +.03 s .029
A′ log β		2.79 −.02	+2.77 +2.41 $-\overset{n''}{.05}$ −.17 +	2.60	9	81		+.19
λ log γ		3.05 −.02	+3.03 +3.29 −.11 −.27	2.76	7	49		+.09
log tang z		2.81 +.01	+2.82 +2.74 −.06 −.19	2.63	6	36		+.03
log r		3.18 +.02	+3.20 +4.44 −.13 −.31	2.89	20	400	±.090	+.05
r		2.75 +.04	+2.79 +3.10 −.04 −.22	2.57	12	144		+.32
z			−.07	2.69				+.136
φ − z = δ (O)		b = +.17						
δ (C)		m = +.23 +.06 + .29						$\frac{.136}{8}$ = ±0.045
δ (C − O)		dT+m	= −2.66					
		dT	= −2.95					

Date Sept. 10 1872 Observer H.A.R. Barom. = log B =

n Recorder W.H. Att. Therm. = log T = log γ

Ex. Therm. = log β =

	19h 40m +10° 19′		19h 45m +8° 32′		19h 49m +69° 57′		20h 5m −1° 11′	
Star.	γ Aquilae		α Aquilae		ε Draconis		θ Aquilae	
	Rc	Hc	Rc	Hc	Rc	Hc	Rc	Hc
T_δ	19 40 6.6	39 52.0	19 44 28.5	44 13.8	48 16.2	47 34.2	20 04 38.6	4 23.9
T_m	8.7	53.9	30.7	15.9	22.4	39.7	40.5	26.0
T_e	10.8	56.0	32.6	18.0	28.5	45.9	42.7	28.2
T_f	12.9	58.2	34.8	20.1	34.5	52.0	44.7	30.2
T_g	15.0	0.2	36.8	22.1	40.5	58.2	46.8	32.3
T_h	17.2	27.8	39.0	51.5	46.5	22.7	48.8	1.0
Sum	19.2	31.9	41.1	53.7	52.8	28.8	50.9	3.4
Mean	21.2	34.0	43.3	55.7	58.5	34.9	53.0	5.4
Red. to T_m	23.3	36.1	45.2	57.8	4.7	41.3	55.0	7.6
Sum = s		38.2		59.8		47.1		9.7
$\frac{1}{5}(T_m - T_s)$	40 1499.989	40 15.030	44 3689.889	44 36.840	48 40.511	48 40.480	4 4678.778	4 46.770
T	14.97	15.01	36.87	36.82	40.47	40.44	46.76	46.75
RA	12.32	12.32	34.16	34.16	37.63	37.63	44.08	44.08
RA − T	2.65	2.69	2.71	2.66	2.84	2.81	2.65	2.67
− n tang δ								
ΔT + m								
$T_m - T_\delta$								
A								
C								
Sum								
Mean								
Red. for runs								
Red. to hor. wire								
Red. to meridian								
Division error								
Sum								
Pointer								
App. z								
log a′								
A′ log β								
λ log γ								
log tang z								
log r								
r								
z								
φ − z = δ (O)								
δ (C)								
δ (C − O)								

Date, Sept. 10 1872 Observer W. A. R.

n Recorder W. H.

Barom. =

Att. Therm. =

Ex. Therm. =

log B =

log T =

log β =

log γ

	20h 13m +77° 20'		20h 18m +39° 51'		××		20h 27m +10° 53'		××	
Star.	κ Cephei		γ Cygni		π Capricorni		1	ε Delphini		Br. 324
	R	W	R	W	R	W	R	W	R	W
T_δ	20 12 37.6	11 30.8	20 17 32.1	17 13.0	20 19 53.8	19 40.4	20 27 2.1	26 47.3	20 30 11.4	29 23.7
T_m	47.4	42.6	34.7	15.7	58.0	42.7	4.2	49.4	17.2	29.8
T_e	56.7	50.2	37.4	18.4	0.2	44.8	6.4	57.5	24.5	87.2
T_f	13 6.3	59.4	40.0	21.2	2.3	47.0	8.5	53.6	31.4	43.8
T_g	15.3	8.7	42.9	23.7	4.6	49.2	10.6	55.9	30.1	50.5
T_h	24.7	21.5	45.6	1.7	6.8	19.9	12.7	35.4	44.8	25.2
Sum	84.0	30.6	48.1	4.3	9.1	22.0	14.8	27.5	51.6	31.8
Mean	43.5	40.3	50.9	6.9	11.0	24.2	17.0	29.6	58.5	38.8
Red. to T_m	52.6	49.8	53.6	9.8	13.2	26.3	19.1	31.7	4.9	41.6
Sum = s		59.1		12.3		28.4		33.8		52.0
$\frac{1}{5}(T_m - T_s)$	13 15.35.344	13 16.30	17 42.811	17 42.70	20 4.556	20 4.49	27 10.600	27 10.55	30 38.16.156	37.84
T	15.28	15.23	42.79	42.68	4.53	4.47	10.58	10.53	31.11	7.79
RA	12.05	12.05	39.99	39.99	1.94	1.94	7.88	7.88	35.04	35.04
RA — T	3.23	3.18	2.80	2.69	2.59	2.53	2.70	2.65	3.07	2.75
— n tang δ										
ΔT + m										
$T_m - T_\delta$										
A										
C										
Sum										
Mean										
Red. for runs										
Red. to hor. wire										
Red. to meridian										
Division error										
Sum										
Pointer										
App. z										
log a'										
A' log β										
λ' log γ										
log tang z										
log r										
r										
z										
φ — z = δ (O)										
δ (C)										
δ (C — O)										

Date Sept. 12 1872 Observer N.A.R. W.N

n Recorder W.N

Barom. =
Att. Therm. =
Ex. Therm. =

log B =
log T =
log β =

log γ

Personal Equation Observations

	19h 0m +13° 41′ ζ Aquilae R	N	19h 3m +35° 54′ ι Lyrae R	N	d Sagittarii ×× R	N	κ Aquilae ×× R	N
Star.								
T_δ	18 59 25.2	59 10.4	19 2 35.8	2 17.9	19 10 2.4	9 47.0	29 54.6	29 39.8
T_m	27.4	12.5	38.6	20.5	4.6	49.2	56.6	41.8
T_e	29.5	14.5	41.0	23.0	6.8	51.3	58.6	44.0
T_f	31.6	16.6	43.6	25.5	9.0	53.6	0.7	45.9
T_g	33.7	18.7	46.0	28.1	11.2	55.8	2.8	48.0
T_h	35.9	48.7	48.6	3.9	13.3	26.5	4.9	17.4
Sum	38.0	50.8	51.2	6.5	15.5	28.7	6.9	19.5
Mean	40.1	53.0	53.7	9.1	17.8	31.0	9.1	21.5
Red. to T_m	42.2	55.1	56.3	11.7	19.9	33.1	11.2	23.6
Sum = s		57.2		14.2		35.2		25.8
$\frac{1}{s}(T_m - T_s)$	59 33.74	.733 59 33.750	2 46.09	.089 46.040	10 11.17	.167 10 11.140	30 2.811	2.730
T	33.72	33.73	46.07	46.02	11.15	11.12	2.79	2.71
RA	33.21	33.21	45.55	41.15	10.73	10.73	2.28	2.28
RA — T T − RA	+.51	+.52	+.52	+.47	+.42	+.39	+.51	+.43
— n tang δ								
ΔT + m								

Time from observations of N.A.R. 4dT = −.04 per hour.

n = −.10

	h	m	s			
$T_m - T_\delta$						
A	19	0	a = +.57 −.04 + .47 +.34 −.03	+ 0.44	3	9
C	19	2	+.52 −.03 .49 +.32 −.03	.46	1	1
Sum	19	10	+.42 −.03 .39 −.35 +.04	43	4	16
Mean	19	30	+.57 −.02 .49 −.13 +.01	48	1	1
Red. for runs	19	40	+.52 −.01 .51 +.18 −.02	49	2	4
Red. to hor. wire	19	44	+.51 −.01 .50 +.15 −.01	49	2	4
Red. to meridian	19	57	+.43 +.00 .43 +.12 −.01	42	5	25
Division error	20	04	+.48 +.01 .49 −.02 +.00	49	2	4 ±.026
Sum	20	17	+.61 +.01 .62 +.83 −.08	54	7	49
Pointer	20	20	+.37 +.02 .39 −.34 +.03	42	5	25
App. z	20	27	+.48 +.02 .50 +.19 −.02	48	1	1
	20	36	+.61 +.03 .64 +.99 −.10	54	7	49
log a′	20	40	+.51 +.03 .54 +.66 −.07	47	0	0
A′ log β	19	53	.50 +.22	0.47 ±.07		.0188
λ′ log γ				n		00157
log tang z	19	48	+ .74 + 0 .74 +2.74 −.09 −.27	+0.47		
log r	20	13	+.82 +1 .83 +4.44 −.08 −.44	0.39		
r	20	30	+.93 +2 .95 +3.10 −.16 −.31	.64		
z	20	03	+.83 +4 .87 +5.71 −.7 −.57	.30		
φ — z = δ (O)			−.10	+0.45		
δ (C)						
δ (C — O)						

b = +.23
m = +.31 + 9 = +.40
dT + m = 0.47
dT = −.087

Date
Observer
Barom. =
Att. Therm. =
Ex. Therm. =
log B =
log T =
log β =
log γ
n
Recorder

	$19^h 33^m$ +49° 56'.		$19^h 40^m$ +10° 19'		$19^h 45^m$ +8° 32'		$19^h 49^m$ +69° 57'		omit till end $20^h 41^m$ +33° 36'	
Star.	o Cygni		η Aquilae		α Aquilae		δ Draconis		ε Cygni (Second)	
	R	W	R	W	R	W	R	W	R	W
T_δ	32 49.9	32 27.2	40 4.4	39 49.6	44 26.3	44 11.6	48 14.0	19 47 31.5	20 40 33.6	36.1
T_m	53.2	30.6	6.5	51.8	28.4	13.7	20.1	38.0	56.1	38.5
T_e	56.3	33.7	8.6	54.0	30.5	15.8	26.3	44.0	58.6	41.0
T_f	59.6	36.7	10.8	56.0	32.6	17.8	32.5	49.7	1.0	43.6
T_g	2.8	40.0	12.8	58.0	34.7	20.0	38.2	55.8	3.5	46.0
T_h	5.9	25.2	14.9	27.5	36.7	49.4	44.4	20.9	5.9	20.8
Sum	9.2	28.4	17.0	29.8	38.9	51.3	50.4	26.7	8.5	23.4
Mean	12.3	31.7	19.1	31.8	40.9	53.4	56.3	32.6	10.9	25.8
Red. to T_m	15.6	35.9	21.3	34.0	43.0	55.6	2.4	38.7	13.4	28.2
Sum = s		38.0	·	36.0		57.7		44.9		30.9
$\frac{1}{5}(T_m - T_s)$	33 2.76 .756	2.740	40 12.83 .822	12.850	44 34.67 .667	34.630	48 38.30 .289	38.280	41 3.500 +1.5	3.430 +1.5
T	2.74	2.72	12.81	12.83	34.61	34.61	38.26	38.24	3.48	3.41
RA	2.06	2.06	12.29	12.29	34.14	34.14	37.52	37.52	3.97	3.97
RA — T	+68	+66	+.52	+.54	+.51	+.47	+.74	+.72	+.57	+44
— n tang δ										
ΔT + m	Time from observations of W. H.									

$T_m - T_\delta$					n = −1.0^s					R−H.	
A	0= +0.52	−04	+48	+34	−03	+0.45	2	4			−01^s
C	.47	−3	.44	+32	−3	41	2	4		+05	
Sum	.39	−3	.36	−35	+4	40	3	9		+03	
Mean	43	−2	.41	−13	+1	42	1	1		+.08	
Red. for runs	54	−1	.53	+18	−2	51	8	64			−02
Red. to hor. wire	.47	−1	.46	+15	−1	45	2	4		+04	
Red. to meridian	.42	+0	.42	+12	−1	41	2	4		+01	
Division error	.42	+1	.43	−02	+0	43	0	0	±.036	+06	
Sum	61	+1	.62	+83	−8	54	11	121		+01	
Pointer	27	+2	.29	−34	+8	32	11	121		+.10	
App. z	45	+2	.47	+19	−2	45	2	4		+03	
	49	+3	.52	+99	−10	42	1	1		+.12	
log a'	0.44	+03	.47	+66	−7	40	3	9		+07	—
A' log β			46	+22		0.43±.010		.0346		+60	−.03 =+.57
λ log γ								00289			
log tang z	~~.66~~				m						
log r	.72	+0	72	+274	−.10					+02	
r	.85	+1	86	+4.44	−9						−.03
z	.78	+2	.80	+3.10	−.12					+15	
φ — z = δ (O)	.92	+4	.96	+5.71	−09						−.09
δ (C)					−.10					—	—
δ (C — O)	dT=+0.83									+17	.12
										+01	

$R - H = +.04^s$

Date Sept. 12　　Observer　　Barom. =　　log B =

n　　Recorder　　Att. Therm. =　　log T =　　log γ

Ex. Therm. =　　log β =

			$20^h 5^m$ $-1° 11'$		$20^h 13^m$ $+77° 20'$		$20^h 18^m$ $+39° 51'$	
Star.	x x T Aquilae		ϑ Aquilae		κ Cephei		γ Cygni	
	19 Re	Ne	Re	Ne	Re	Ne	Re	Ne
$T_δ$	57 47.3	57 32.6	4 36.3	4 21.5	12 35.3	11 29.1	17 29.8	17 10.7
T_m	49.4	34.8	38.3	23.8	44.4	38.4	32.5	13.4
T_e	51.4	36.8	40.5	26.0	54.0	48.0	35.1	16.1
T_f	53.4	38.8	42.5	27.9	3.4	57.2	37.9	19.0
T_g	55.6	40.9	44.5	29.9	12.6	6.2	40.6	21.6
T_h	57.8	10.2	46.6	59.1	22.0	19.0	43.2	0.4
Sum	59.8	12.3	48.7	1.0	31.7	28.6	45.9	2.0
Mean	1.9	14.5	50.7	3.1	41.2	37.6	48.6	4.8
Red. to T_m	3.9	16.5	52.8	5.3	50.5	47.3	51.3	7.4
Sum = s		18.6		7.3		56.8		10.1
$\frac{1}{5}(T_m - T_s)$	57 55.611	55.600	4 44.58.544	44.490	13 12.79.789	12.820	17 40.55.544	40.550
T	55.59	55.58	44.53	44.47	12.72	12.76	40.58	40.53
RA	55.16	55.16	44.05	44.05	11.90	11.90	39.92	39.92
RA — T	+.43	+.42	+.48	+.42	+.82	+0,85	+0,61	+.61
— n tang δ								
ΔT + m								
$T_m - T_δ$								
A								
C								
Sum								
Mean								
Red. for runs								
Red. to hor. wire								
Red. to meridian								
Division error								
Sum								
Pointer								
App. z								
log a′								
A′ log β								
λ′ log γ								
log tang z								
log r								
r								
z								
φ — z = δ (O)								
δ (C)								
δ (C — O)								

Date

n

Observer

Recorder

Barom. =

Att. Therm. =

Ex. Therm. =

log B =

log T =

log β =

log γ

Star.	π Capricorni × ×			ε Delphini 20h 27m +10° 53′		Groom 3241 × ×		ζ Cygni 20h 37m +44° 50′	ε Cygni 20h 41m +33° 30′	[illegible] 1879 × ×
	Re	N	Re	N	Re 8.9	N	Re 15	Re	Re	N
T_δ	19 33.6	19 38.1	27 59.9	26 45.1	30 15.8	29 21.8	36 54.1	36 33.4	52 35.9	51 11.5
T_m	55.8	40.4	2.0	47.3	22.6	28.2	57.0	36.3	48.0	23.7
T_e	58.0	42.4	4.0	49.3	29.2	35.0	59.8	39.3	59.7	35.7
T_f	0.2	44.7	6.3	51.4	36.0	41.7	2.8	42.2	11.5	47.7
T_g	2.3	46.9	8.4	53.5	42.5	48.1	5.7	45.0	23.9	59.3
T_h	4.5	17.7	10.5	23.1	49.4	23.2	8.7	26.0	35.6	47.9
Sum	6.6	19.7	12.6	25.3	56.0	29.9	11.5	29.0	47.8	0.2
Mean	8.8	21.9	14.7	27.2	2.8	36.5	14.3	32.0	59.5	11.9
Red. to T_m	11.0	24.1	16.7	29.4		43.2	17.3	34.8	11.8	24.0
Sum = s		26.2		31.6		50.0		37.7		36.5
$\frac{1}{5}(T_m - T_s)$	20 2.311	2.210	27 8.35.344	8.320	30 35.911	35.760	37 6.569.689	6.570 53	23.75.744	23.84
T	2.29	2.19	8.33	8.30	35.86	35.71	+15 6.67	+15 6.55	23.66	23.75
RA	1.92	1.92	7.85	7.85	34.93	34.93	6.06	6.06	22.83	22.83
RA — T	+.37	+.27	+.48	+.45	+.93	+.78	+.61	+.49	+.83	+.93
— n tang δ										
ΔT + m										

$T_m - T_\delta$										
A										
C										
Sum										
Mean										
Red. for runs										
Red. to hor. wire										
Red. to meridian										
Division error										
Sum										
Pointer										
App. z										
log a′										
A′ log β										
λ log γ										
log tang z										
log r										
r										
z										
φ — z = δ (O)										
δ (C)										
δ (C — O)										

Date Sept. 18 1872 Observer W. H. R. Barom. = log B =
Att. Therm. = log T = log γ
n Recorder Ex. Therm. = log β =

Observations for Personal Equation – Single (s) and double (d) wires

Star.	ν Cygni 20ʰ 18ᵐ +39° 51′		π Capricorni × ×		Groom. 3241 × ×		ε Cygni 20ʰ 41ᵐ +33° 30′	
	Re	s He	d Re	He	Re	s He	Re	We
T_δ	30 17 21.8	17 2.9	20 19 45.8	19 30.6	20 30 0.7	29 13.8	20 40 46.7	40 29.3
T_m	24.6	5.7	48.0	32.8	7.5	20.3	49.1	31.8
T_e	27.4	8.3	50.2	35.0	14.1	26.8	51.7	34.2
T_f	30.0	10.9	52.4	37.0	21.0	33.6	54.2	36.7
T_g	32.6	13.7	54.6	39.3	27.6	40.3	56.6	39.2
T_h	35.3	67.6	56.8	9.8	34.4	15.1	59.1	14.0
Sum	38.0	54.1	59.0	12.0	41.2	22.0	1.6	16.6
Mean	40.7	57.0	1.2	14.2	47.8	28.3	4.1	19.0
Red. to T_m	43.4	54.6	3.4	16.4	54.7	35.5	6.6	21.5
Sum = s		2.5		18.7		41.7		24.0
$\frac{1}{8}(T_m - T_s)$	32.622	32.630	54.600	54.580	27.666	27.740	56.633	56.630
T	32.602	32.61	54.58	54.56	27.61	27.69	56.61	56.61
RA	39.81	39.81	61.82	61.82	34.59	34.59	3.88	3.88
RA — T	−7.21	7.20	7.24	7.26	6.98	6.90	7.27	7.27
— n tang δ								
ΔT + m								

From double wires

$T_m - T_\delta$			$n = -.18^s$	$n = -.08$		$b = +.26$
A	$20^h\ 17^m$	$0 = -7.21^s + .80 - .18$	-7.29	$-.06$	-7.27	$m = +.35 + .07 = +.42$
C	20 19	$7.24 - .34 + 3$	27	$+.03$	27	$dT + m = +7.30$
Sum	20 39	$7.27 + .66 - 7$	34	$-.05$	32	$dT = 6.88$
Mean	~~20 40~~	$7.26 + .78 - 8$	34	$-.06$	32	
Red. for runs	20 34	$7.25 + .48$	7.31		7.31	
Red. to hor. wire				$n = -.08$		
Red. to meridian		$0 = -6.98 + 3.09\ \overset{n}{-.10} + -.34 -$		7.29		
Division error		$6.88 + 5.71 - .8 + -.46$		7.35		
Sum				7.31		
Pointer						
App. z						
log a′						
A′ log β						
λ log γ						
log tang z						
log r						
r						
z						
ϕ — z = δ (O)						
δ (C)						
δ (C — O)						

Date Sept. 18 1872 Observer W. R. Barom. = log B =
n Recorder Att. Therm. = log T =
Ex. Therm. = log β = log γ

XX 21h 1m +38° 8'

Star. 12 Fl 1479 61 Cygni Sep. 19 1872

	Re	N	Re	N					
T_δ	20 52 27.3	51 3.5	21 00 54.2	0 35.5	19 32 10.8	19 39 55.7	40.9	19 44 17.7	2.9
T_m	40.0	15.1	56.8	38.3	14.0	57.7	43.0	20.0	5.0
T_e	57.4	27.2	59.4	41.0	17.0	59.9	45.0	22.0	7.1
T_f	3.5	38.9	2.0	43.6	20.3	2.0	47.1	24.0	9.4
T_g	15.5	51.5	4.7	46.2	23.5	4.1	49.3	26.0	11.4
T_h	27.5	39.6	7.2	23.0	26.8	6.2	18.8	28.0	40.7
Sum	39.1	61.9	19.9	25.8	30.0	8.3	20.9	30.3	42.8
Mean	57.3	8.5	12.6	28.5	33.2	10.4	23.0	32.4	44.8
Red. to T_m	8.7	15.8	15.0	31.0	36.4	12.5	25.1	34.4	47.0
Sum = s		27.6		33.7	23.444		27.3		49.1
$\frac{1}{5}(T_m - T_s)$	15.479	15.460	4.633	4.660		4.084	4.040	26.089	26.020
T	15.38	15.37	4.61	4.64					
RA	22.26	22.26	11.88	11.88					
RA — T	6.88	6.89	7.26	7.24					
— n tang δ									
ΔT + m									

From single wires

$T_m - T_\delta$	n = -.10
A	0 = 7.20 + .80 − .08 − 7.28
C	7.26 − .34 + .03 7.29
Sum	7.27 + .66 − .07 7.34
Mean	7.24 + .78 − .08 7.32
Red. for runs	7.24 + 48 7.31
Red. to hor. wire	
Red. to meridian	0 = 6.90 + 3.09 − .13 − .31 − 7.21
Division error	6.89 + 5.71 − .07 − .57 − 7.46
Sum	−.10 7.33
Pointer	
App. z	
log a'	
A' log β	
λ' log γ	
log tang z	
log r	
r	
z	
φ — z = δ (O)	
δ (C)	
δ (C — O)	

Date Sept. 19 1872 Observer WAR Barom. = log B =

n Recorder RH Att. Therm. = log T = ______ log γ

Ex. Therm. = log β =

For Personal Equation

Star.	λ Aquarii 22h 29m −0°46′		10 Lacertae ~~ζ Pegasi~~ 22h 34m +38 24		13 Lacertae 22h 39m +41°10′		μ Pegasi ~~ι Cephei~~ 22h 44m +23°57	
	R	H	R	H	R	H	R	H
T_δ	22 28 32.8		22 33 15.4	33 56.0	22 38 7.4	51.5	22 43 34.9	18.9
T_m	34.9		17.8	59.0	9.5	53.7	37.1	21.2
T_e	36.9		20.3	1.7	11.9 16.5	56.0	39.4	23.5
T_f	39.0		22.9	4.4	18.5	58.3	41.6	25.7
T_g	41.0		25.6	6.9	20.7	00.5	43.9	28.0
T_h	43.0	32.8	28.3	44.0	23.0	32.2	46.1	59.8
Sum	45.2	34.9	31.0	(46.6)	25.2	34.4	48.5	2.0
Mean	47.2	36.9	33.5	(49.3)		36.5	50.7	4.3
Red. to T_m	49.3	38.0	36.2	52.0		38.7	53.0	6.6
Sum = s		41.0		54.6		41.0		8.8
$\frac{1}{5}(T_m - T_s)$	28 41.033		33 25.611	25.55	38 ~~18.479~~ 16.314	16.280	43 43.911	43.880
T	41.02		25.59	25.53	16.29	16.26	43.89	43.86
RA	49.18	49.18	33.64	33.64	24.39	24.39	57.99	57.99
RA − T	−8.16		8.05	8.11	8.10	8.13	8.10	~~8.7~~ 8.13
— n tang δ		R − H	+.05		+.03		+.03	
ΔT + m								

Time from observations of W A R.

n = −.06

$T_m - T_\delta$			
A	$0 = -8.16^s - .01 + 0$	8.16	$b = +.30^s$
C	$8.05 + .79 - 5$	10	$m = +40 + 05 = +.45$
Sum	$8.10 + .42 - 2$	12	$dT + m = +8.13$
Mean	$8.10 + .44 - 3$	13	$dT = 7.68$
Red. for runs	$8.21 + .26 - 4$	22	
Red. to hor. wire	$7.99 + 1.51 - 9$	8	
Red. to meridian	$8.17 + .05 - 0$	17	
Division error	$8.10 + .42 - 2$	12	
Sum	$8.08 + .59 - 3$	11	
Pointer	$8.03 + 1.03 - 6$	9	
App. z		$8.13 \pm .007$	
log a′	n		
A′ log β	$-8.05 + 2.40 - .03 - 14$	8.19	
λ′ log γ	$8.82 - 2.75 - 7 + .17$	15	
log tang z	$7.87 + 4.30 - 7 - .27$	.14	
log r	$-.06$		
r			
z			
φ − z = δ (O)			
δ (C)			
δ (C − O)			

Date Sept. 19 1872 Observer WAR. Barom. = log B =

Att. Therm. = log T =

n Recorder WH. Ex. Therm. = log β = log γ

	22h 59m +14° 32′		23h 7m +56° 29′		23h 11m +2° 36′		× ×	
Star.	α Pegasi		Br. 3077		γ Piscium		o Cephei	
	Ke	Wh	Ke	He	Ke	Wh	Ke	Wh
T_δ	2258 87	57 540	2306 475	214	2310 179	31	2312 568	188
T_m	109	56.0	51.4	259	200	53	20	242
T_e	131	582	550	288	221	74	74	297
T_f	153	02	590	325	242	96	129	350
T_g	174	25	27	362	262	118	180	402
T_h	195	322 344	65	289	283	408	237	555
Sum	215	367	102	326	302	428	292	13
Mean	238	388	140	365	323	448	345	69
Red. to T_m	260	410	177	402	343	470	399	121
Sum = s	1			439		491		177
$\frac{1}{5}(T_m - T_s)$	58 17.378	17.400	7 2.666	2.610	10 26.166 167	26.160	13 18.266 267	18.140
T	17.36	17.38	2.65	2.59	26.15	26.14	18.28	18.10
RA	28.57	25.57	10.64	10.64	34.32	34.32	46.68 26.28	26.28
RA — T	8.21	8.19	7.99	8.05	8.17	8.18	8.06	8.18
— n tang δ	—.02		+.06		+.01		+.13	
ΔT + m								

Time from Observations of W. H.

n = -.05

$T_m - T_\delta$

A R – H a =

C a = 8.11 +.79 –.05 – 8.16 0 0 b = +.30

Sum 8.13 + .42 – 2 15 1 1 m = +.40 + .5 = +.45

Mean 8.13 +.44 3 16 0 0 dT+m = +8.16

Red. for runs 8.19 +.26 1 20 4 16 dT 7.71

Red. to hor. wire 8.05 +1.57 1 19 4 16

Red. to meridian 8.18 +.00 0 18 2 4

Division error 8.11 +.42 2 13 3 9

Sum 8.17 +.59 3 20 4 16

Pointer 8.07 +1.03 5 13 4 16

App. z 8.16 ±.007

log a′

A′ log β 8.18 +2.40 –.01 –.18 ~~2.36~~ 8.30 (n)

λ log γ 8.23 – 2.75 –.12 +.14 8.59

log tang z 8.06 +4.30 – .02 – .27 8.27

log r –.05

r

z

ϕ — z = δ (O)

δ (C)

δ (C — O)

R – H

Date Sept. 19 1872 Observer W A R.

n Recorder W H

Barom. =

Att. Therm. =

Ex. Therm. =

log B =

log T =

log β =

log γ

Star.	η Pegasi ~~4 bats.~~	23h 19m +22° 43'	XX. λ Draconis		23h 28m +30° 38' v2 Pegasi		23h 31m +45° 47' λ Andromedae		23h 34m +4° 57' γ Cephei	
T_δ	23 18 47.1 (48.0)	29.1	23 23 12.8	30.4	23 27 21.3	4.4	23 31 1.0	40.1	23 33 27.8	23.1
T_m	49.4	31.4	19.0	36.0	23.5	5.7	4.0	43.3	37.0	32.4
T_e	51.7	33.7	25.2	41.7	26.0	9.0	7.0	46.3	45.8	41.0
T_f	54.0	35.9	31.1	47.9	28.4	11.5	10.0	49.1	54.9	57.0
T_g	56.2	38.1	37.4	54.1	30.8	14.0	13.0	52.0	4.0	59.9
T_h	58.4	9.9	43.0	19.4	33.1	47.7	16.0	33.8	13.7	8.1
Sum	0.7	11.8	49.0	25.1	35.5	50.0	18.9	36.6	22.6	17.2
Mean	2.9	14.1	55.3	31.4	37.8	52.5	21.8	39.7	31.4	26.8
Red. to T_m		16.5	12	37.7	40.4	54.8	24.7	40.6	40.8	35.8
Sum = s		18.8		43.7		57.1		45.0		45.0
$\frac{1}{5}(T_m - T_s)$	53.933 53.93	53.930	37.111	36.700	30.755	30.670	12.933	12.900	~~30.889~~ 4.232	4.030
T	53.92 53.925	53.91	37.09	36.65	30.74	30.65	12.~~86~~ 92	12.88	4.15	3.96
RA	2.02	2.02	45.88	45.88	38.82	38.82	20.95	20.95	12.02	12.02
RA — T	8.10	8.11	8.82	~~9.03~~ 8.23	8.08	8.17	8.03	8.07	7.87	8.06
— n tang δ	+.01		-		+.09		+.04		+	
ΔT + m										

$T_m - T_\delta$

A

C

Sum

Mean

Red. for runs

Red. to hor. wire

Red. to meridian

Division error

Sum

Pointer

App. z

log a'

A' log β

λ log γ

log tang z

log r

r

z

φ — z = δ (O)

δ (C)

δ (C — O)

Sept. 19 1872

On this date, after consultation with the Director, concluded to use all the stars of the new Polar Catalogue, i.e. all common to the Catalogue and the Ephemeris as new stars for the zones. Hence from this date the new stars will not be copied into this book but will be taken directly from the Polar Star Books A, &c.

These books will be hereafter used for time stars, a sufficient number being selected from each night's work to give the time ~~for~~ with sufficient accuracy for general or specific purposes.

Date Sep. 28 1872 Observer W.A.R.
n Recorder
Barom. =
Att. Therm. =
Ex. Therm. =
log B =
log T =
log β =
log γ

	X X	22h 15m	22h 19m	X X	22h 37m
Star.	75 Draco	31 Pegasi	8 Lacer.	226 B Cep.	2 Pegasi
		+11° 35m	+51° 36'		+29° 34'
T_δ	21 50 43.4	22 14 58.7	22 18 12.8	22 29 24.0	22 37 44.8
T_m	50.5	0.8	16.2	32.5	47.2
T_e	57.4	2.8	19.3	40.3	49.6
T_f	4.6	5.0	22.7	48.7	52.0
T_g	11.7	7.1	26.0	57.5	54.4
T_h	18.9	9.2	29.4	5.6	56.8
Sum	25.7	11.2	32.8	14.0	59.0
Mean	33.0	13.3	36.2	21.9	1.4
Red. to T_m	40.0	15.5	39.5	30.3	3.7
Sum = s	11.71	7.07	26.09	57.20	54.32
$\frac{1}{5}(T_m - T_s)$	11.65	7.05	26.07	57.14	54.30
T	19.48	15.36	34.21	5.04	2.60
RA	7.83	8.31	8.14	7.90	8.30
T − R.A. // RA − T	−7.83	−8.31	−8.14	−7.90	−8.30
— n tang δ					
ΔT + m					

n = −.15

h m s
22 14 0 = −8.31 + .20 −.03 — 8.34
22 18 −8.14 + 1.26 −.17 — 8.31
22 37 −8.30 + .57 −.08 — 8.38

22 22 − 8.25 + .68 —8.34

m
21 50 0 = −7.83 + 3.29 −.16 −.49 8.32
22 37 7.90 + 3.88 −.14 −.58 8.48
−8.38

b = +.23s
m = +.31 + 13 = +.54
dT + m = +8.38
dT = +7.84

Sep. 28 1872 W.A.R.

$T_m - T_\delta$					
A	3 Lacer. 75 Draco		α Aquarii	3 Lacer.	226 B Ceph.
C	21 50 57.1	22 54 40.7	21 55 2.3	22 18	22 29 40.2
Sum	0.6	42.9	8.4		44.8
Mean	4.5	45.0	4.4		48.5
Red. for runs	7.6	47.1	5.4		52.5
Red. to hor. wire	11.3	49.3	6.4		57.1
Red. to meridian	14.7		7.5		0.8
Division error	18.2		8.6		5.2
Sum	22.1		9.6		9.1
Pointer	25.2		10.6		13.3
App. z	11.26	46.04	6.47		56.84
	11.20	45.02	6.45		56.78
log a'					
A' log β					
λ log γ					
log tang z					
log r					
r					
z					
φ − z = δ (O)					
δ (C)					
δ (C − O)					

n = −.11

0 = −8.46 + .22 − .02 −8.48
− 8.43 − .02 + .00 − 8.43
−8.45 + .10 − 8.45

0 = −8.10 + 3.29 − .11 − .36 − 8.46
− 8.06 + 3.88 − .10 − .43 − 8.49

b = + .23
m = +.31 + .10 = +.41
ΔT + m = +8.45
ΔT − = +8.04

Date Oct. 2 1872 Observer W.A.R.

n

Recorder

Barom. =

Att. Therm. =

Ex. Therm. =

log B =

log T =

log β =

log γ

Star.	$18^h\ 13^m$ 5 Urs Mi	$18^h\ 33^m$ α Lyrae	xx 51 Ceph.	$18^h\ 45^m$ β Lyrae	$18^h\ 52^m$ ~~53~~ R Lyrae	$19^h\ 49^m$ δ Urs Mi
	+86° 36′	+38° 40′		+33° 13′	+43° 47′	+88° 56′
T_δ	18 13	18 32 23.5	18 38 25.0	18 48 9.0	18 51 13.4	19 50 55
T_m		26.2	45.7	10.4	16.2	3.8
T_e		28.8	7.5	11.6	19.0	56.0
T_f		31.5	28.0	12.8	21.9	52.7
T_g		34.2	50.6	14.1	24.8	46.7
T_h	18 18.7		11.5	15.3		
Sum			33.4	16.5		
Mean			53.6	17.7		
Red. to T_m			65.8	19.0		
Sum = s						
$\frac{1}{5}(T_m - T_s)$		28.84	50.10	14.04	19.06	56.90
T	13 18.4	28.82	50.43	14.02	19.04	51 57.77
RA	26.1	37.04	58.17	22.14	27.17	52 4.80
RA — T	−7.70	−8.22	−7.74	−8.12	−8.13	−7.03
— n tang δ						
ΔT + m						

n = +.01

0 = −8.22 + .80 + .01 − 8.23

−8.12 + .65 + .01 .12

−8.13 + .96 + .01 .13

−8.16 + .80 8.15

0 = −7.70 + 16.80 − .03 + .14 7.87

−7.74 + 20.40 + .02 − .21 7.95

−7.03 + 58.42 + .02 + .53 7.56

b = +.19

m = +.25 + 1 = +.26

dT + m = 8.17

dT = +7.91

(If b = .23

m = .31 + 1 = .32

dT = +8.06)

Oct. 3 1872 W.A.R. obs.

$T_m - T_\delta$			
A	Gr. 3241	α Cygni	ζ Delph.
C	20 30 12.0	20 36 51.8	20 4[illegible] 32.6
Sum	19.0	54.8	34.7
Mean	26.0	57.7	36.9
Red. for runs	32.0	0.5	39.0
Red. to hor. wire	39.3	3.3	41.1
Red. to meridian			
Division error	25.66	57.62	36.86
Sum	25.60	57.60	36.84
Pointer	33.64	5.61	44.86
App. z	−8.04	−8.01	−8.02
log a′			
A′ log β			
λ log γ			
log tang z			
log r			
r			
z			
φ — z = δ (O)			
δ (C)			
δ (C — O)			

n = 0

0 = −8.04 + .31.0 + 0 −8.04

−8.01 + 0.28 + 0 8.01

−8.02 + 0.99 + 0 8.02

+8.02

b = +.17

m = +.23

dT + m = +8.02

dT = +7.79

Date 1872 Oct. 9. Observer W. A. R.

n Recorder

Barom. =
Att. Therm. =
Ex. Therm. =

log B =
log T =
log β =

log γ

	18h 13m	18h 33m	18h 45m	19h 19m	x x	
Star.	δ Ursa Min.	α Lyrae.	β Lyrae.	δ Aquilae.	51 Cephei	
	+86° 36′	+38° 40′	+33° 13′	+2° 52′		
T_δ	18 12 8.6	32 13.2	44 59.3	19 18 43.7	18 38 27.1	
T_m	24.7	15.8	2.1	45.8	50.0	
T_e	42.2	18.6	4.4	48.0	11.1	
T_f	59.8	23.9	9.3	52.0	32.8	
T_g	17.2	26.5	11.7	54.1	51.8	
T_h	34.5	29.0	14.3	56.2	13.9	
Sum	51.1	31.7	16.8	58.3	35.8	
Mean	9.4	34.4	19.2	0.4	58.1	
Red. to T_m	27.2	39.7	24.1	4.4	18.7	
Sum = s		42.4	26.8	6.5		
$\frac{1}{5}(T_m - T_s)$		44.9	29.0	8.6		
T						
RA						
RA — T						
— n tang δ						
ΔT + m	Oct. 10. 1872	ζ Aquilae.	δ Draco.	δ Aquilae.	α Aquilae	λ Ursa Min.
		18 39 8.5	19 12 15.1	18 52.2	44 13.5	48 8.7
$T_m - T_\delta$		10.6	18.0	54.2	15.6	49 0.0
A		12.7	20.7	56.3	17.7	49 56.5
C		16.8	23.3	58.5	21.8	50 53.4
Sum		18.9	26.0	0.5	24.0	51 − 45.9
Mean		21.0	28.7		26.0	52 43.2
Red. for runs		23.1	31.4		28.0	4
Red. to hor. wire		25.1			30.1	53 35.2
Red. to meridian		29.3			34.4	27.0
Division error		31.3			36.5	55 27.0
Sum		33.4			38.6	
Pointer		20.97	23.31	56.34	26.02	46.33
App. z		20.95	23.27	56.32	26.00	45.50
			30.84	4.06	33.70	54.06
log a′			−7.57	−7.74	−7.70	−8.56
A′ log β						
λ′ log γ						
log tang z						
log r						
r						
z						
φ — z = δ (O)						
δ (C)						
δ (C — O)						

Date 1872 Oct. 10 Observer W. A. R Barom. = log B =

Att. Therm. = log T = ________ log γ

n Recorder Ex. Therm. = log β =

With Russian Transit

Star.	20h 33m 73 Draco. +74° 32′	20 42m 6 Hev. Ceph. +57° 08′	——	21h 8m ζ Cygni +29° 43′	21h 10m τ Cygni +37° 31′
T_δ	20 32 28.7	41 20.6	41 47.6	21 7 13.6	9 24.0
T_m	36.7	24.2	3.6 51.5	16.0	26.6
T_e	44.8	27.9	3.7 55.1	18.6	29.7
T_f	52.6	31.7	3.8 59.3	21.0	32.4
T_g	0.6	35.8	41 3.4	23.4	35.1
T_h	8.5	30.7	49 7.0	25.9	
Sum	17.1	34.5	38 11.0	28.4	
Mean	24.7	38.6	41 15.0	30.9	
Red. to T_m	33.0	42.4	38 18.9	33.3	
Sum = s		46.4	40 3.09		
$\frac{1}{5}(T_m - T_s)$					
T	33 0.75	3.28	3.09	23.45	35.10
RA		3.24 11.51	3.05 11.51	23.43 31.03	08 42.59
RA — T		-8.23	-8.42	-7.60	-7.59
— n tang δ					
ΔT + m					
$T_m - T_\delta$					
A					
C					
Sum					
Mean					
Red. for runs					
Red. to hor. wire					
Red. to meridian					
Division error					
Sum					
Pointer					
App. z					
log a′					
A′ log β					
λ′ log γ					
log tang z					
log r					
r					
z					
ϕ — z = δ (O)					
δ (C)					
δ (C — O)					

Assume c = 0

0 = -7.60 + 0.57 + 52 - 7.08

-7.51 + 0.77 + 70 - 6.81

0 = - 8.36 + 1.55 + 1.41 - 6.95

0 = - 7.56 + .67

0 = -0.80 + 88

n = + 0.91

dT + m = + 6.94 b = + .15

m - 62 m = + 20 - 82

dT = + 7.56 = - .62

sin φ = .67

cos φ = .74

a = m sin φ - n cos φ

= -.42 - 68 = -1.10

Date Oct. 12 1872 Observer W.R.

n

Recorder

Barom. =
Att. Therm. =
Ex. Therm. =

log B =
log T =
log β =

log γ

With Meridian Circle.

Star.	20h 18m +39° 57'	20h 37m +44° 50'	20h 41m +15° 40'	21h 16m +62° 3'
T_δ	γ Cygni	α Cygni	γ Delphini	α Cephei
T_m	20h 17 16.0	20 36 40.9	20 40 24.7	21 14 59.1
T_e	18.6	43.7	26.9	3.5
T_f	21.3	46.4	29.0	8.2
T_g	26.1	52.3	33.3	16.6
T_h	29.3	55.0	35.4	21.1
Sum	32.0	58.3	37.6	25.6
Mean	34.8	1.1	39.7	30.6
Red. to T_m	37.6	4.0	41.9	34.4
Sum = s	42.8	9.6	46.1	43.4
$\frac{1}{s}(T_m - T_s)$	45.6	12.7	48.4	47.8
T	48.3	15.6	50.4	52.1
RA	32.09	58.15	37.59	25.67
RA — T	32.07	58.13	37.57	25.64
— n tang δ	35.27	5.38	44.72	32.79
ΔT + m	- 7.20	- 7.25	- 7.15	- 7.15

n = 0

c = + 7.20
7.25
7.15
7.15
75
7.19

b = +20
m = +27
dT+m = +7.19
dT = +6.92

Oct 12 W.A.R. Obs. with Russian Transit C. E.

$T_m - T_\delta$	1981 Urs Min (5 wires)	λ Aquarii 9 w	10 w.	ζ Pegasi 9 w	10 w	ι Cephei 9 w	10 w	α Piscis Aust.	
A	22 21 19.9	22 28 33.1	28 18.3	22 34 50.9	36.0	22 44 49.9 (48.5)	44 6.8	22 50 18.8	2.9
C	45.3	38.3	20.5	53.0	38.0	52.5	11.8	22.3	5.3
Sum	14.0	37.4	22.5	55.3	40.1	57.7	16.8	24.7	7.7
Mean	41.1	39.4	24.6	57.2	42.3	3.0	22.0	27.5	10.0
Red. for runs	8.1	41.5	26.6	59.4	44.6	7.9	27.0	29.7	12.5
Red. to hor. wire	34.8	43.8	56.3	1.6	14.8	12.9	35.0	32.4	47.0
Red. to meridian	2.5	40.7	58.6	8.7	16.8	18.3	44.3	34.9	49.4
Division error	29.8	48.0	0.8	6.0	18.8	23.5	49.3	37.0	57.9
Sum	54.7	50.1	2.8	8.1	21.0		54.4	35.6	54.5
Pointer			5.0		23.2		59.4		55.9
App. z	23 7.80	41.59 41.57 49.05	41.60 41.58 49.05	59.47 59.46 6.99	59.56 59.54 6.99	2.91 2.87 10.33	3.08 3.04 10.33	29.77 29.75 36.27	29.81 29.79 36.27
log a'		7.48	7.47	7.54	7.45	7.46	7.28	7.52	7.28
A' log β									
λ log γ									
log tang z									
log r									
r									
z									
φ — z = δ (O)									
δ (C)									
δ (C — O)									

Value of div. of level = $.13^s$

n = -.05s

c = -7.47 -.01 +.00 -7.47

7.50 +.18 +.01 .49

7.51 -.58 +.03 .48

-7.49 -.14 7.48

b = +.11s

m = +.15 + 4 = +.19

dT+m = +7.48

7.29

c = - n -

= -7.37 + 2.20 -.05

Date Oct. 12 Observer [illegible] Barom. = log B =

Att. Therm. = log T = ______ log γ

n Recorder Ex. Therm. = log β =

Join Russian Transit.

Star	22h 59m +14° 32'		23h 11m +2° 36'		x x		x x		23h 34m +76° 56'	
T_δ	α Pegasi		γ Piscium		o Capri.		θ Piscium		γ Cephei	
			9 w	10 w	9 w	10 w	9 w	10 w	9 w	10 w
T_m	22 58 9.7	37 54.5	23 10 18.8	23 10 ~~x~~	23 12 58.2	12 19.1	23 21 15.5	0.6	23 32 25.7	23.4
T_e	11.9	56.7	20.6	4.0	3.7	24.7	17.7	2.7	38.0	32.8
T_f	14.1	58.8	22.9	6.0	9.5	30.5	19.8	4.8	44.0	42.0
T_g	16.3	1.0	25.3	9.1	14.6	35.8	21.9	6.9	57.3	54.6
T_h	18.6	3.1	27.2	10.1	20.3	41.5	24.0	9.0	6.9	1.0
Sum	20.9	34.0	29.4	12.2	26.0	59.0 4.4	26.1	39.0	16.9	~~25.6~~ ~~12.7~~
Mean	22.9	36.2	31.6	42.3	~~30.6~~ 31.4	10.0	28.4	41.0	25.6	~~34.4~~ 22.0
Red. to T_m	25.2	38.5	33.8	44.4	~~35.8~~ 36.7	15.9	30.6	43.1	34.7	31.0
Sum = s	27.4	40.6	35.9	46.5	~~41.6~~ 42.3	21.0	32.6	45.4	44.3	40.8
$\frac{1}{5}(T_m - T_s)$		42.8		48.6				47.6		49.9
T			27.31	27.32	20.24	20.19	24.07 24.05	24.01 23.99	6.78	6.78
RA	18.55	18.62					30.98	30.98	6.72	6.72
RA — T	18.53	18.60			25.92	25.92	30.98	30.98	11.53	11.53
— n tang δ	25.50	25.40			5.68	5.73	6.93	6.99	4.81	4.81
ΔT + m	6.97	6.80								

$T_m - T_\delta$	φ Pegasi		ω Piscium	
	9 w	10 w	9 w	10 w
A	23 45 40.5	29.9	23 52 31.3	16.6
C	47.7	32.0	33.6	18.7
Sum	45.8 52.1	34.1	35.7 37.7	20.8
Mean	54.6	36.3	40.0	23.0
Red. for runs	56.7	38.6	42.3	25.1
Red. to hor. wire	58.9	10.1	44.3	55.0
Red. to meridian	1.2	12.4	46.5	57.1
Division error	3.2	14.6	48.6	59.3
Sum		16.8		1.4
Pointer		19.0	~~47.14~~	3.7
App. z	54.41	54.38	39.99 ~~41.14~~	40.07
			39.97	40.05
log a'			46.89	46.89
A' log β			6.92	6.84
λ log γ				
log tang z				
log r				
r				
z				
φ — z = δ (O)				
δ (C)				
δ (C — O)				

n = -.53 b = -.05

0 = -6.93 +.26 - 13 7.06 m = -.01 + .48 = +.47

= -6.96 + .10 - .05 7.01 dT + m = +7.00

= 6.88 + .12 - .06 6.94 dT = 6.63

-6.92 + .16 7.00

7.29

6.63

0 = -5.71 + 2.40 -.55

13.92

4.81 + 4.30 -.51 dT = +6.96

-.53