

XXXV. *Astronomical Observations made at Leicester. By the Reverend Mr. Ludlam, Vicar of Norton, near Leicester. Communicated by the Astronomer Royal.*

Redde, May 11, 1775.

OBSERVATIONS FOR DETERMINING THE LATITUDE OF THE PLACE.

Zenith distances taken with an eighteen inch quadrant, made by BIRD.

1774.	β Draconis on quadrantal arch		γ Draconis on quadrantal arch.	
	Degrees M. S.	Parts. S. V.	Degrees. D. M. S.	Parts of 96. P. S. V.
July 2	9 32	1 5 $\frac{1}{4}$	1 6 40	1 1 7 $\frac{3}{4}$
10	9 20	1 5 $\frac{1}{4}$	1 6 34	1 1 7 $\frac{1}{2}$
14	9 20	1 5 $\frac{1}{3}$	1 6 34	1 1 7 $\frac{1}{2}$
15	9 20	1 5 $\frac{1}{6}$	1 6 28	1 1 7 $\frac{1}{4}$
20	9 20	1 5 $\frac{1}{8}$	1 6 27	1 1 7 $\frac{1}{3}$
Mean	9 22,4	1 5 $\frac{1}{40}$	1 6 32,6	1 1 7 $\frac{1}{50}$

	On arch of excess.		On arch of excess.	
	M. S.	S. V.	D. M. S.	P. S. V.
June 30	8 58	1 4 $\frac{1}{4}$	1 6 12	1 1 6 $\frac{1}{2}$
July 4	8 50	1 4 $\frac{1}{8}$	1 6 6	1 1 6 $\frac{3}{4}$
9	8 58	1 4 $\frac{1}{6}$	1 6 4	1 1 6 $\frac{1}{2}$
16	8 58	1 4 $\frac{1}{6}$	1 6 6	1 1 6 $\frac{1}{2}$
18	8 58	1 4 $\frac{1}{8}$	1 6 6	1 1 6 $\frac{3}{4}$
Mean	8 56,4	1 4 $\frac{1}{6}$	1 6 6,8	1 1 6 $\frac{3}{8}$

N. B. The seconds were shewn by the micrometer screw, the fractional parts estimated by the eye.

Reduce

Reduce the parts of 96 to degrees, and take the mean between the zenith distances shewn on each scale, and the zenith distance of β Draconis on the quadrantal arch will be $9^{\circ} 21,7$, and on the arch of excess $8^{\circ} 54$, whence the true zenith distance is $9^{\circ} 7,8$, and the error of the line of collimation $13,8$, to be subtracted from the numbers shown on the limb of the quadrant. In like manner we shall find the true zenith distance of γ Draconis $1^{\circ} 6' 19,8$, and the error of the line of collimation $13,5$. If we suppose the apparent declination of β Draconis on July 12th to be $52^{\circ} 28' 52,3$, that of γ Draconis $51^{\circ} 31' 41,7$, we have the latitude from the former $52^{\circ} 38'$, and from the latter $52^{\circ} 38' 1''$.

N. B. Some observations on these two stars in July 1772, give the same latitude within less than $2''$, but make the error of the line of collimation $23''$ to be subtracted. I suspect the line of collimation is liable to small variations in portable quadrants, if not in all.

Zenith distances of α Herculis with the state of the barometer and thermometer.

1774.	Degrees.	Parts of 96.	Barom.	Therm.
	D. M. S.	P. S. V.	Inches.	Degrees.
June 50	37 57 36	40 3 14 $\frac{1}{2}$	29,7	58
July 2	37 57 46	40 3 14 $\frac{3}{4}$	29,8	65
4	37 57 40	40 3 14 $\frac{1}{2}$	29,7	56
9	37 57 41	40 3 14 $\frac{2}{3}$	29,7	55
10	37 57 36	40 3 14 $\frac{1}{3}$	29,7	55
16	37 57 36	40 3 14 $\frac{2}{3}$	30,0	65
18	37 57 32	40 3 14 $\frac{1}{4}$	30,0	56
20	37 57 32	40 3 14 $\frac{1}{3}$	29,8	58
Mean	37 57 37,4	40 3 14 $\frac{11}{24}$	29,8	58,5

The mean of the zenith distances shewn on the two scales of divisions is $37^{\circ} 57' 32''$. Add for refraction $43,4$: subtract for line of collimation $13,6$: and we have the true zenith distance $37^{\circ} 58' 1,8$. Suppose the apparent declination of α Herculis on July 12th to be $14^{\circ} 39' 58,5$, we have the latitude $52^{\circ} 38'$.

Zenith distances of the Pole-Star.

1774.	Degrees.	Parts of 96.	Barom.	Therm.
	D. M. S.	P. S. V.	Inches.	Degrees.
Nov. 10	35 27 56	37 6 9 $\frac{1}{2}$	30,05	31
11	35 27 55	37 6 9 $\frac{1}{2}$	29,87	32
13	35 27 56	37 6 9 $\frac{1}{2}$	30,20	34
Mean	35 27 55,6	37 6 9 $\frac{1}{2}$	30,04	32,3
Dec. 6	35 28 8	37 6 10 $\frac{1}{4}$	30,27	30
15	35 28 4	37 6 10 $\frac{1}{4}$	30,03	44
Mean	35 28 6	37 6 10 $\frac{1}{4}$	30,15	37
Dec. 12	39 15 0	41 6 14 $\frac{3}{4}$	29,83	44
13	39 15 4	41 6 15	28,86	44
15	39 15 0	41 6 14 $\frac{1}{2}$	30,08	38
Mean	39 15 1,3	41 6 14 $\frac{3}{8}$	29,59	42

Take the mean between the two scales of divisions, and we have the mean zenith distances, as follows :

Days of the month.	Obs. zenith dist.	Cleared of refr.
	D. M. S.	D. M. S.
Nov. 10 11 13	35 27 49,5	35 28 33,5
Dec. 6 15	35 28 0,3	35 28 44,
Dec. 12 13 15	39 14 59,3	39 15 46,7

The mean zenith distance of Nov. 10. 11. 13. cleared of refraction, is 35° 28' 33,5". To this add 7,5" for the increase of apparent declination between Nov. 12. and Dec. 12. and we have the zenith distance on Dec. 12. (as derived from the observations in November) 35° 28' 41".

The fame from the actual observations on Dec. 6. and 15. is $35^{\circ} 28' 44''$. The mean of these two, corrected for the line of collimation, gives the true zenith distance above the pole, $35^{\circ} 28' 28,9$. The observations of Dec. 12. 13. 15. cleared of refraction and corrected for the line of collimation, give the true zenith distance below the pole, $39^{\circ} 15' 33,1$, whence the latitude $52^{\circ} 37' 59$, and the apparent declination of the pole star, Dec. 12th, $88^{\circ} 6' 27,9$. From all these observations we may conclude the latitude of (St. Martin's church in) Leicester is $52^{\circ} 38'$, within very few seconds^(a). From some observations made with an HADLEY'S quadrant of six inches radius, and given in the Transactions for 1769, I made the latitude only $52^{\circ} 37' 3''$; but those observations cannot be set in competition with these, either for weight or number.

Occultations of γ and α Tauri, observed at Leicester,
Nov. 18, 1774.

	Time by the clock.
	H. M. S.
Emerfion γ Tauri,	VI 27 10
Immerfion α Tauri. Touched the limb,	XIV 59 26.
Vanifhed,	XIV 59 30
Emerfion α Tauri instantaneous,	XVI 12 38'

(a) The observations were made in Wigfton's hospital adjoining to the church..

The following observations serve to examine the clock.

Transits of the Sun.				
Day of the Month.	1st wire.	Time of the Clock.		3d wire.
		Meridian.		
1774.	M. S.	H.	M. S.	M. S.
Nov. 17	43 35	XXIII	44 24½	45 11½
	45 54		46 43	47 30
18	43 50	XXIII	44 39	45 26
	46 8½		46 57	47 44

Hence the *rate* of going was conformable to mean time.

Zenith distances taken with the eighteen inch quadrant, to ascertain the absolute error of the clock, Nov. 18. Barometer 29,6 inches. Thermometer 33°.

Time by clock.		Degrees.	Parts of 96.		Object.
H.	M. S.	D. M.	P.	S. V.	
VIII	0 0	67 11½	71	5 6	} α Aquilæ.
	2 46	67 35½	72	0 13½	
	12 15	68 59	73	4 11	
	14 37	69 20	73	7 10½	} α Aquilæ.
	48 4	56 45½	60	4 5½	
	50 55	56 20½	60	0 13½	} α Tauri.
	53 23	55 59½	59	5 13	
XI	1 57	55 21	59	0 5	} β Geminorum.
	3 54	55 3	58	5 12	
	6 35	54 39	58	2 5	
XVI	26 33	58 45½	62	5 7	} α Tauri.
	29 49	59 14½	63	1 8	
	33 9	59 44	63	5 12	
	36 15	60 11½	64	1 10	

From

From the mean of the two first zenith distances of α Aquilæ the clock will be found to be slower than mean time 14". By the second pair of α Aquilæ, 13". By the next three zenith distances of α Tauri, 13". By the next three of β Geminorum, 16", By the last four of α Tauri, 17"; the error of the line of collimation being 13,6 as before. The mean of all these gives the clock 14,6 slower than mean time. Hence,

	<u>Solar time.</u>
	H. M. S.
Emerfion of γ Tauri,	vi 41 48,4
Immerfion α Tauri. Touched limb,	xv 13 59,6
Vanifhed,	xv 14 3,6
Emerfion α Tauri, infantaneous,	xvi 27 10,8

The emerfion of α Tauri was obferved at Greenwich
at xvi 34 36,8 folar time.

N. B. The immerfion of ζ Tauri (behind the Moon) which was obferved at Leicefter, April 28, 1770, at
ix 45 44 folar time, was alfo obferved at Greenwich at
ix 51 28,6 folar time. See Phil. Tranf. for 1770.