CAMPAIGN FOR DETERMINING THE LONGITUDE OF THE FUNDAMENTAL POINT OF THE ASTRONOMIC OBSERVATORY IN NAPLES

V. ASTRONOMIC LONGITUDE AND GEOGRAPHIC LONGITUDE

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1. — THE EQUATION FOR SENSITIVITY OF THE LEVEL

Determination of the variation in the level's sensitivity as a function of temperature t was carried out with a Heurtaux comparator by mean of a series of measurements carried out periodically during the year of observation.

The equation obtained is the following :

$$\sigma_{t^\circ} = 0^s\!.08492 + 4.857\ 10^{-6}\ t^\circ$$

with

$\sigma_0 = 0^s\!.08492 \pm 0^s\!.000153$

$\alpha = (4.857 \pm 0.098)\ 10^{-6}$ sec/°C

The temperature of the observatory dome was recorded during the night's observation session. For reducing the striding level readings to seconds of time the corresponding value for σ obtained from the above equation was used.

2. — COMPUTATION OF CORRECTIONS TO THE OBSERVED TRANSIT TIME DUE TO INEQUALITIES IN THE PIVOTS

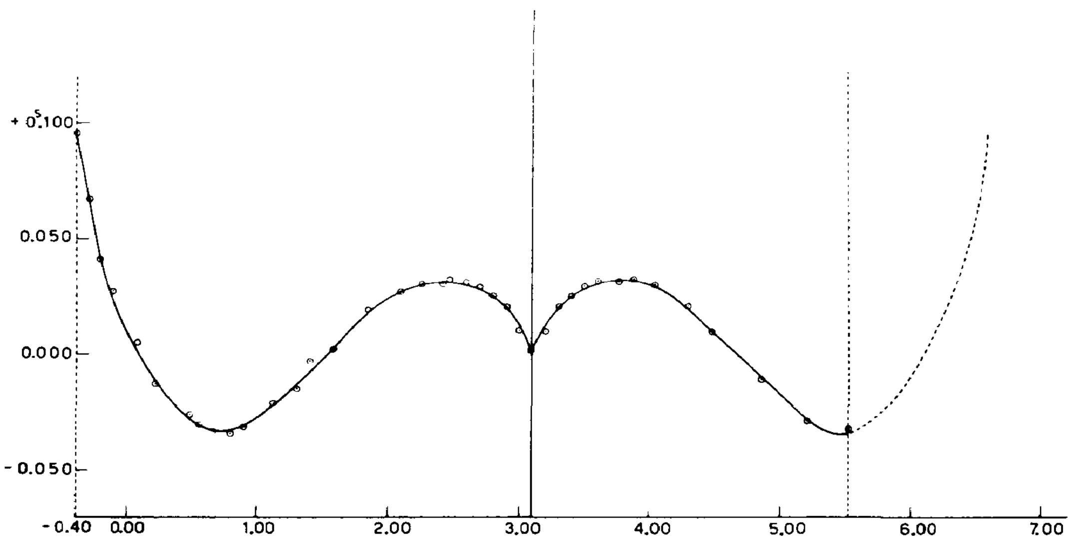
The value for the inclination i of the instrument's secondary axis of rotation was accurately measured for each observed star in the two positions of the instrument, as was described in the first article of this series.

The whole programme of star observations was, for each sidereal hour, centred on the value of tan φ (See the fourth article in this series) — i.e. for every right ascension hour the stars were uniformly distributed in relation to the zenith of the place of observation. In view of this we computed firstly the mean value i_m relating to the whole of the night's work, and secondly for each star the difference :

$$di = i - i_m$$

i being the inclination for a given star.

By this means we noted that the various di for a given star observed over several nights always retained the same sign. In order to get confirmation of these results, during the nights when meteorological conditions made observation impossible, we carried out a series of fictitious observations for zenith distances at every 10°, and then we went on to read the striding level in the way mentioned above. The results obtained confirmed the behaviour of the di values obtained from star observations as a function of the zenith distance.



GRAPH 1
$di = f(\tan \delta)$

Graph No. 1 represents the aspect of the relation $di = f$ (tan δ) on the left, deduced only from the observed values, whereas the dotted line portion on the right results from the fictitious measurements since stars with declinations over 79° were not used for the star programme arranged.

From this graph we drew up a table which allowed us to determine the values for the Σ_1 corrections (see the third article in this series) to be applied to the observed time of transit in order to eliminate the effect of the inequalities in the pivots.

3. — EQUATION FOR THREAD OF THE IMPERSONAL MICROMETER SCREW

The thread of the micrometer screw was computed for each star by averaging six values obtained from making two consecutive complete turns of the screw first in one direction and then in the other.

To compute the explicit function $R = R(t^{\circ})$ we used only the mean values obtained during one night's observations coupled with the mean values for temperature t° of the observation room from thermometer readings taken at the beginning and the end of each sidereal hour of observation.

The equation obtained is

$$R_{t^{\circ}} = 4\overset{s}{.}70091 - 4.37\, 10^{-5}\, t^{\circ}$$

with

$R_0 = 4\overset{s}{.}70091 \pm 0\overset{s}{.}00037$

$\alpha = (4.37 \pm 0.64)\, 10^{-5}$

For the final reduction of our observations we have however used the mean value R_m obtained night by night.

4. — HALF-WIDTH OF THE CONTACTS AND PLAY OF THE SCREW

We proceeded to determine the half-width of the impersonal micrometer's contacts by means of 60 groups of measurements carried out during the year employing the standard method.

The mean value obtained is :

$$\text{s.c.} = 0\overset{s}{.}07567$$

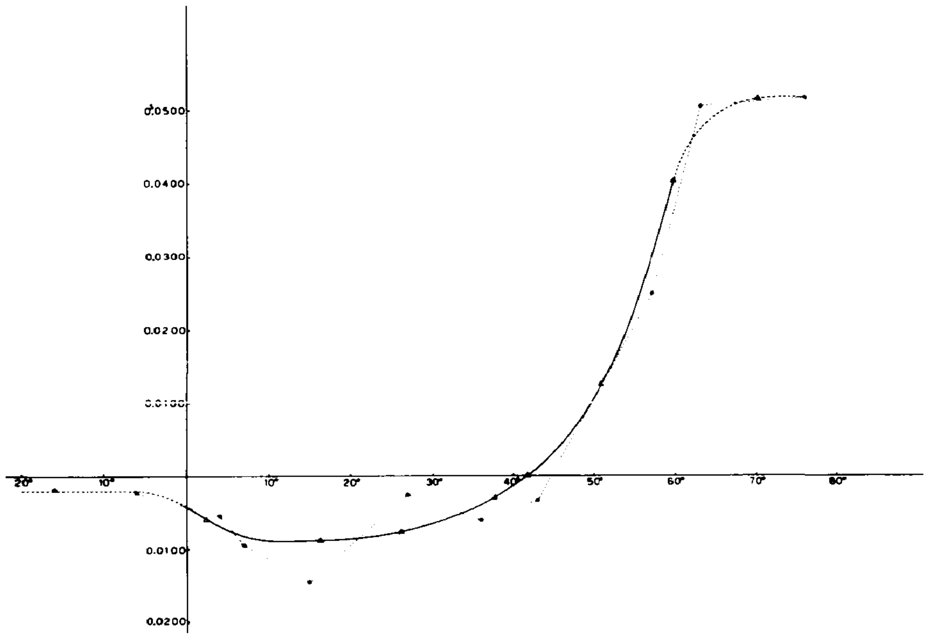
Observations for measuring the delay due to screw play were made by exploring the portion of the eyepiece field used for our observations by means of a sighting mark set at a practically infinite distance.

The mean correction obtained for the delay due to play is :

$$\text{p.m.} = 0\overset{s}{.}0068 \sec \delta$$

5. — RESIDUAL COLLIMATION

To compute this correction we used all the observed stars, taking an average for each series of observations and computing the differences for each star (see third article in this series).



GRAPH 2
$dc = f(\delta)$

As in the case of the inclination, the angle measurements for each star obtained during various nights were assembled and this enabled us to draw up graph No. 2 which represents the function :

$$dc = f(\delta)$$

Correction Σ_4 to be applied to each observed transit to take into account the residual collimation effect was derived from this graph.

6. — STAR PROGRAMME AND COMPUTATION OF OBSERVER'S ERROR IN ESTIMATION OF TIME OF TRANSIT

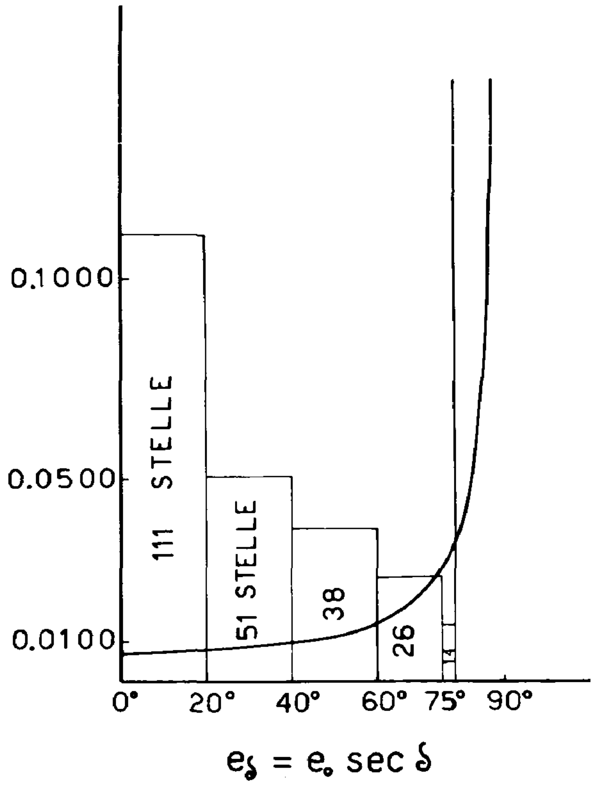
Mr. A. PUGLIANO compiled the star programme shown in table I, taking the most favourable conditions for solving the longitude equation into account (see fourth article in this series).

Table II gives the most favourable conditions of the star programme for each hour of right ascension.

Graph No. 3 gives the statistical distribution of all the stars in the entire programme in terms of their declination. The continuous curve shows the trend of the error $e_\delta = e_0 \sec \delta$ when estimating the time of transit of a star of declination δ.

The mean value obtained for this error taking all the observations into account is :

$$e_0 = \pm\ 0^s.0073$$



GRAPH 3

Graph No. 3 shows how this error e_δ is compensated through the number of stars observed.

TABLE 1

Observational programme

No FK4	Mag	α	δ	No FK4	Mag	α	δ
1630	4.7	$0^h00^m.2$	$-\ 6°12'$	107	2.8	$3^h00^m.5$	$+\ 3°58'$
2	2.4	07. 4	+ 58 58	111	3 v	06. 0	+ 40 50
7	2.9	11. 5	+ 15 00	114	4.5	09. 7	+ 19 36
1005	4.5	16. 5	+ 36 36	115	5.5	16. 0	+ 77 37
1010	6.0	23. 7	+ 1 45	1096	5.5	21. 8	+ 64 28
16	4.2	31. 1	+ 62 45	124	4.5	28. 2	+ 47 53
19	4.5	36. 8	+ 29 08	1099	4.3	32. 3	− 21 45
24	5 v	43. 4	+ 74 48	135	3.7	41. 7	− 9 52
1022	4.9	51. 3	− 1 19	142	3.8	47. 2	+ 23 57
1024	6.7	57. 1	− 6 04	149	3.2	56. 5	− 13 36
37	6.2	$1^h02^m.1$	$+\ 1°11'$	151	3.9	$4^h01^m.4$	$+\ 5°54'$
40	3.6	06. 9	− 10 21	152	4.0	06. 2	+ 47 38
1033	5.6	12. 0	+ 7 24	1117	4.3	12. 5	+ 48 20

No FK4	Mag	α	δ	No FK4	Mag	α	δ
45	4.7	17. 6	+ 27 05	159	3.9	17. 9	+ 15 33
48	2.8	23. 6	+ 60 04	164	3.6	26. 7	+ 19 07
50	3.7	29. 7	+ 15 11	1125	4.7	32. 0	+ 14 47
51	5.5	35. 8	+ 72 52	1126	5.7	39. 3	+ 28 33
1047	5.5	40. 1	+ 35 05	173	6.0	44. 4	+ 75 53
1050	5.7	46. 4	+ 16 48	1135	5.1	49. 4	+ 18 47
63	3.4	52. 0	+ 63 31	181	2.9	54. 8	+ 33 07
73	2.3	$2^h01^m.9$	$+ 42°10'$	1137	4 v	$5^h00^m.2$	$+ 41°02'$
75	3.1	07. 6	+ 34 50	188	2.9	06. 2	− 5 08
1059	5.6	13. 8	+ 24 53	192	4.8	11. 2	+ 38 27
1064	6.0	20. 5	− 17 49	1145	4.8	16. 8	+ 40 04
1066	4.9	24. 3	− 12 26	1147	4.6	20. 1	− 0 25
1070	5.4	30. 1	+ 36 00	203	5.7	27. 0	+ 63 03
87	5.3	34. 8	+ 72 41	205	6.4	35. 3	+ 75 02
1077	5.6	41. 9	+ 44 09	216	5.5	43. 3	+ 49 49
99	3.9	48. 2	+ 55 46	222	3.9	49. 9	− 20 53
1082	5.0	57. 0	+ 35 03	226	3.8	54. 9	− 14 10
1163	4.3	$6^h02^m.1$	$+ 23°16'$	1235	5.8	$9^h00^m.2$	$- 0°21'$
233	5.4	09. 5	+ 65 44	1238	5.1	06. 0	+ 10 48
1169	5.1	14. 5	+ 12 17	346	5.3	11. 6	+ 43 21
244	4.5	22. 0	+ 4 37	350	6.6	17. 1	+ 17 51
246	5.0	26. 3	− 4 44	1244	4.6	22. 7	+ 26 20
1174	4.5	31. 1	+ 7 22	355	3.7	29. 0	+ 63 12
250	5.7	36. 4	+ 39 25	1249	4.8	36. 7	+ 4 48
254	3.2	41. 9	+ 25 10	1252	5.6	41. 9	+ 14 10
258	4.7	46. 1	+ 2 27	1255	5.2	46. 5	+ 46 11
260	4.7	55. 2	+ 77 01	372	6.0	55. 5	+ 73 02
1182	5.2	$7^h00^m.4$	$+ 24°16'$	1261	4.7	$10^h03^m.5$	$- 12°54'$
1185	5.9	06. 0	+ 7 31	381	3.8	09. 0	− 12 11
1187	4.1	10. 2	− 0 26	383	3.5	15. 1	+ 43 05
276	5.7	15. 7	+ 40 57	386	3.2	20. 4	+ 41 40
1191	5.3	21. 9	+ 40 44	390	4.4	26. 0	+ 36 53
284	5.8	27. 5	+ 68 32	1272	5.7	30. 4	+ 14 18
1196	4.2	33. 9	+ 26 58	1275	4.8	36. 9	+ 32 09
293	4.1	39. 7	− 9 28	1276	5.3	41. 6	+ 46 23
1199	5.4	44. 4	+ 37 36	1281	5.8	48. 6	− 8 43
1205	5.1	50. 0	+ 1 51	413	6.3	57. 3	+ 77 57
300	5.6	56. 2	+ 74 01				
1213	6.3	$8^h00^m.8$	$- 6°15'$	418	4.7	$11^h03^m.3$	$+ 7°31'$
307	4.9	06. 0	+ 51 36	420	3.1	07. 8	+ 44 41
310	5.7	15. 4	+ 75 52	422	2.6	12. 3	+ 20 42
314	4.4	20. 6	+ 43 18	1293	4.8	17. 3	+ 38 22
1222	5.9	26. 8	+ 14 19	1295	7.1	24. 0	+ 26 56
320	6.0	30. 8	+ 38 08	433	4.1	29. 5	+ 69 31
1223	4.2	35. 9	+ 5 49	437	4.5	35. 2	− 0 38
1228	4.7	41. 4	+ 21 35	1300	5.5	39. 3	+ 34 23
1230	5.2	47. 7	− 3 19	1303	6.6	45. 4	+ 61 35
335	3.1	56. 9	+ 48 10	1310	6.3	56. 4	+ 32 27

No FK4	Mag	α	δ	No FK4	Mag	α	δ
451	6.0	$12^h03^m.6$	+ 77°05′	555	3.6	$15^h00^m.7$	+ 40°31′
1313	6.3	08. 8	+ 17 00	1396	5.0	05. 8	+ 25 00
456	3.4	13. 8	+ 57 13	559	4.7	10. 3	− 19 40
460	4.0	18. 2	− 0 29	564	2.7	15. 2	− 9 16
461	5.2	24. 2	+ 39 12	569	3.1	20. 8	+ 71 57
1323	4.8	33. 2	+ 22 49	1407	5.9	26. 4	− 16 36
475	4.8	37. 5	− 7 49	1409	4.8	32. 4	− 9 57
1327	5 v	43. 6	+ 45 37	1413	5.0	40. 0	− 19 34
1333	6.5	50. 6	+ 17 15	590	4.3	45. 2	+ 77 54
1336	5.9	57. 9	− 3 38	1416	4.6	51. 5	+ 42 33
1337	5.1	$13^h04^m.2$	+ 35°58′	598	4.1	$16^h01^m.3$	+ 58°39′
491	6.0	08. 5	+ 38 40	1423	4.9	07. 8	+ 36 34
494	4.7	16. 1	+ 40 45	603	3.0	12. 6	− 3 37
499	6.1	25. 3	+ 72 34	608	3.9	18. 7	+ 46 23
1351	4.9	32. 4	+ 3 50	613	4.5	23. 9	+ 14 06
505	5.7	36. 4	+ 71 25	623	6.4	32. 0	+ 77 31
1357	5.7	42. 7	− 16 01	624	5.0	39. 7	− 17 41
510	5.1	48. 1	− 17 58	1436	6.0	45. 6	+ 2 07
1360	6.3	54. 7	+ 32 12	1441	5.3	51. 7	+ 31 45
1362	6.3	58. 1	− 3 28	633	3.4	56. 1	+ 9 26
1365	6.4	$14^h02^m.6$	− 14°49′	1446	5.3	$17^h00^m.4$	+ 33°37′
524	5.0	08. 9	+ 77 42	636	6.3	06. 7	+ 40 33
525	4.2	14. 3	− 5 51	643	3.4	13. 9	+ 36 51
1374	6.3	21. 6	− 11 34	1454	5.2	18. 8	+ 18 05
1379	4.4	27. 6	+ 75 51	1458	6.3	24. 2	− 1 37
1381	6.2	35. 2	− 12 10	653	3.0	29. 7	+ 52 20
545	3.9	41. 3	− 5 31	656	2.1	33. 4	+ 12 35
1386	6.0	47. 8	+ 37 57	1463	4.9	41. 4	− 21 40
1388	6.7	52. 0	+ 6 23	675	5.0	50. 9	+ 76 58
1393	5.7	55. 8	− 0 02	674	3.8	56. 5	+ 29 15
680	3.7	$18^h05^m.8$	+ 9°33′	795	5.9	$21^h06^m.2$	+ 78°00′
1475	6.3	15. 6	− 9 46	797	3.4	11. 5	+ 30 05
688	3.4	19. 6	− 2 55	1558	4.3	16. 1	+ 39 15
1479	5.7	24. 7	+ 29 49	1562	5.5	22. 4	− 13 01
700	5.8	31. 3	+ 77 31	808	3.1	29. 8	− 5 43
701	6.0	36. 1	+ 65 28	1569	4.8	36. 0	− 8 00
702	5.1	41. 7	− 8 19	817	4.8	41. 4	+ 71 10
1491	4.4	45. 6	+ 18 09	818	5.4	44. 8	− 11 31
711	4 v	54. 3	+ 43 54	1579	6.6	54. 8	+ 21 05
712	4.2	58. 1	+ 15 01	1580	6.4	57. 2	− 4 32
717	3.5	$19^h04^m.5$	− 4°56′	830	5.4	$22^h04^m.0$	+ 62°37′
1500	5.4	10. 9	− 8 00	835	4.4	08. 5	+ 33 01
724	4.5	15. 2	+ 38 04	840	4.3	15. 1	− 7 57
734	6.0	23. 7	+ 79 32	842	4.0	20. 0	− 1 33
1510	4.8	30. 5	+ 34 23	1585	4.6	23. 6	+ 1 13
738	4.6	35. 5	+ 50 09	1593	5.5	29. 6	+ 78 39
1513	4.4	39. 6	+ 17 24	1595	5.3	36. 0	− 4 24
1517	5.1	44. 4	− 19 51	855	3.6	39. 8	+ 10 40

No FK4	Mag	α	δ	No FK4	Mag	α	δ
745	0.9	49. 2	+ 8 47	859	4.1	44. 9	+ 23 23
1521	4.0	55. 1	+ 35 00	1600	6.0	53. 5	+ 36 54
1524	5.6	$20^h02^m.5$	+ 7°11′	869	4 v	$23^h00^m.4$	+ 42°09′
759	4.4	10. 0	+ 77 37	1603	4.7	05. 3	+ 9 14
1527	4.5	15. 8	− 12 37	875	5.6	11. 7	+ 56 59
765	2.3	21. 0	+ 40 09	1609	5.2	17. 2	− 9 47
1534	4.1	28. 0	+ 30 15	1613	5.5	23. 2	+ 32 12
1537	6.7	32. 3	+ 4 47	1616	5.5	33. 0	+ 40 03
772	5.2	37. 5	+ 9 58	893	3.4	38. 0	+ 77 27
783	3.6	44. 6	+ 61 43	1621	5.3	42. 5	− 18 28
1547	4.8	50. 9	− 9 06	1625	5.4	50. 9	+ 10 46
788	4.0	55. 9	+ 41 02	1629	4.7	56. 1	+ 24 57

TABLE 2

$$K = \tan \varphi - \frac{\tan \delta_r}{r}$$

AR	K	AR	K	AR	K	AR	K
0^h	0.000	6^h	− 0.002	12^h	+ 0.007	18^h	+ 0.001
1^h	− 9	7^h	+ 3	13^h	+ 8	19^h	− 1
2^h	+ 5	8^h	+ 1	14^h	+ 9	20^h	− 6
3^h	− 2	9^h	+ 7	15^h	+ 3	21^h	− 1
4^h	− 7	10^h	+ 6	16^h	+ 1	22^h	− 6
5^h	− 1	11^h	+ 2	17^h	+ 8	23^h	− 7

7. — STUDY OF THE VARIATION IN INSTRUMENT AZIMUTH

To study the variation in azimuth during the whole observation we computed the following equation by the least squares method :

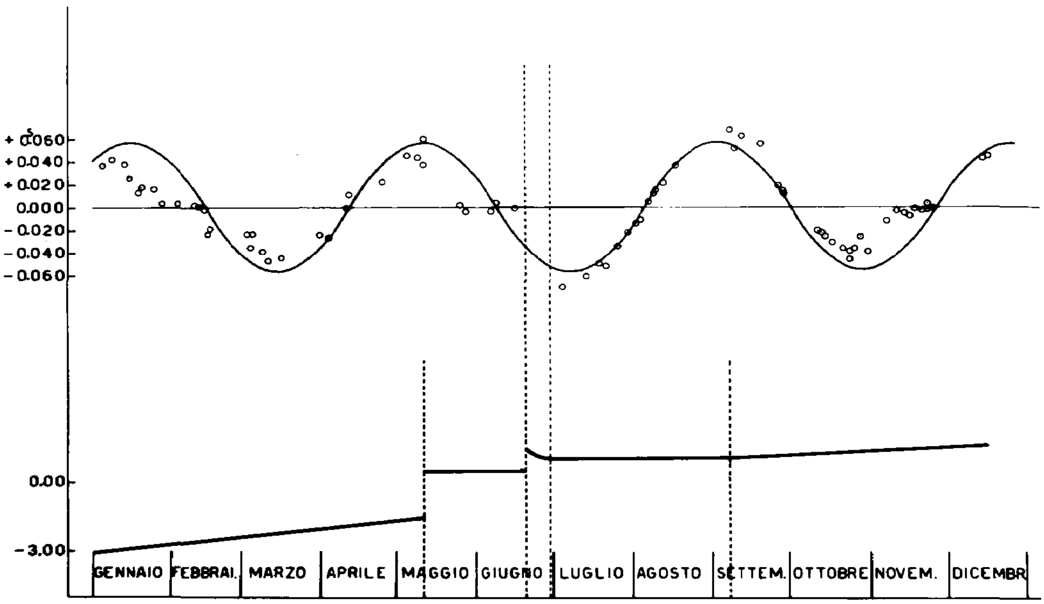
$$Az = ad + b$$

where d is the date of the observation, and a and b are two constants (a indicating the daily variation of the instrument azimuth, and b the azimuth value at the beginning of the observations). In other words, we have assumed from the beginning the azimuth variation to be linear, attributing this variation to the displacements that the instrument undergoes independent of any variations that the pillar may undergo.

This variation is shown in graph No. 4 by three straight lines, since between 10 and 24 May, 14 and 16 June, as well as 16 August and 9 September there were abrupt variations in azimuth due certainly to the instrument being jarred during the course of the observations or else as a result of cleaning the equipment.

The variations in azimuth that the transit instrument's supporting pillar underwent have been represented in this manner.

To find the variations undergone by this pillar we computed the differences between the azimuth values obtained from observation and the values deduced from the above equation.



GRAPH 4

Variations that almost certainly arise from the pillar are oscillatory in character with a period of about 114 days (graph No. 4). The maximum and minimum points on the graph are nearly coincident with the periods of new moon. Thus, between two consecutive lunations it would seem that the pillar has undergone torsion first in one direction and then in the opposite direction.

With our present knowledge of this subject we did not manage to find an explanation for this phenomenon. And in actual fact we should exclude the possibility of this variation being caused by the long-period constituents of the tide-generating potential, for the reason that not only have these constituents a period of 14, 28, 182 or 365 days but also because their amplitude is extremely small.

The phenomenon could be interpreted by considering it together with the local vertical, but here again we come up against difficulties of interpretation which are not at all easily surmounted.

From this graph we computed the Σ correcting term. (See the third article in this series).

8. — CORRECTIONS TO BE MADE TO THE TIME SIGNALS

To determine the duration of propagation and accordingly the time when the signal is transmitted from the transmitter antennae we followed the principles adopted for the reduction of the observations of the I.G.Y. in 1957-58. However, since the transmitting stations were more than 1000 km away from Naples, in order to determine the values of apparent velocity of propagation for short waves we employed the following asymptotic formula :

$$V_d = \left(290 - \frac{139.41}{d + 2.9}\right) 10^3 \text{ km/sec}$$

d being the geodetic distance between transmitter and receiver expressed in thousands of kilometres.

By using the orthodromic distance d_0 computed from tables published in Appendix IV (Haversines) of item 52 in " Frequency and Time Division " (Palo Alto) this geodetic distance d was computed by the formula :

$$\text{hav}\, d_0 = 0.75628 \cos\varphi \,\text{hav}\, |\lambda - 14^\circ\!.2555| + \text{hav}\,(\varphi - 40^\circ\!.8628)$$

Taking $s = 1/297$ as the flattening value, and with $a = 6378.388$ km we computed the geodetic distance d by means of the well-known Andoyer formula :

$$d = d_0 + sd_0 \sin^2 \frac{1}{2}(\varphi + \varphi_{NA}) \cos^2 \frac{1}{2}(\varphi - \varphi_{NA}) \frac{3R - 1}{2C} -$$

$$- sd_0 \cos^2 \frac{1}{2}(\varphi + \varphi_{NA}) \sin^2 \frac{1}{2}(\varphi - \varphi_{NA}) \frac{3R + 1}{2S}$$

where :

$$S = \sin^2 \frac{d_0}{2a} \qquad\qquad C = \cos^2 \frac{d_0}{2a}$$

$$R = \sqrt{SC} : \frac{d_0}{2a}$$

φ and λ being the coordinates of the transmitting station taken from the Paris B.I.H. Bulletins.

The duration of propagation T expressed in seconds of time was therefore obtained by the relation :

$$T = \frac{d}{V_d}$$

(d being expressed in km)

9. — COMPUTATION OF TU_2

The correction ΔT_s for the short-period variations of the earth's rotation was computed from the Tables of the Paris B.I.H. for the year 1967. The correction for polar displacement was computed with the x and y coordinates of the instantaneous pole in relation to the mean pole as supplied by the central S.I.L. office in Mizusawa.

For the longitude computations we then took into account a very small correction :

$$\Delta\lambda_p = \frac{1}{15}\, y \tan \varphi_{\text{Greenw.}}$$

arising from the displacement of the fundamental meridian resulting from the effect just mentioned.

10. — CONVENTIONAL LONGITUDE ADOPTED

For the computation of right ascensions of stars observed at their meridian transit with the Bamberg instrument selected we assumed the following values for the coordinates :

$$\lambda_{\text{Bamb}} = -\,0^h57^m01\overset{s}{.}5550$$

$$\varphi_{\text{Bamb}} = +\,40°51'46\overset{''}{.}33$$

With these data Professor A. Kranic (see the third article in the present series) compiled the times of star transits at the above meridian.

Since the axis of the transit instrument pillar was 42.35 m East of the fundamental point for the Capodimonte Astronomic Observatory (which is the axis of its north dome) the correction to be applied to the longitude of the axis of the Bamberg instrument's pillar in order to obtain the longitude of the fundamental point is :

$$\Delta\lambda = +\,0.1266$$

Thus the value assumed for the conventional longitude of the fundamental point of the observatory is :

$$\lambda_c = -\,0^h57^m01\overset{s}{.}4284$$

11. — ASTRONOMIC LONGITUDE OBTAINED

The final value for the astronomic longitude was computed by using a weighted mean of the values appearing in Table III, taking as weight the

TABLE 3

Astronomic longitude

(Obs. : A. Pugliano)

n°	Date 1967	0^h57^m	μ_λ	n°	Date 1967	0^h57^m	μ_λ
1	1 – 4.752	$1^s.3096$	± $0^s.0011$	45	7 – 12.873	$1^s.3011$	± $0^s.0015$
2	7.771	3202	26	46	14.857	3046	6
3	12.775	3020	37	47	17.890	3086	10
4	14.769	3119	15	48	19.885	3126	7
5	18.839	3024	26	49	24.871	3056	5
6	19.755	3084	24	50	28.798	3084	22
7	25.822	3078	18	51	31.789	3083	13
8	28.752	3082	21	52	8 – 2.701	3103	12
9	2 – 3.777	3093	28	53	5.776	3117	17
10	9.846	3047	11	54	7.833	3113	7
11	10.797	3005	33	55	9.828	3022	6
12	13.852	3068	18	56	11.822	3019	6
13	14.861	3104	21	57	16.808	3108	7
14	15.787	3106	31	58	9 – 6.835	3077	7
15	3 – 2.869	3057	36	59	8.829	3101	9
16	3.741	3000	27	60	11.821	3083	8
17	4.864	3050	27	61	18.843	3058	7
18	8.770	2968	81	62	25.866	3116	8
19	10.764	3138	30	63	27.757	3069	12
20	15.792	3047	23	64	27.798	3075	8
21	31.831	3051	22	65	10 – 10.783	3073	3
22	4 – 3.818	3046	31	66	12.778	3072	6
23	10.825	3089	12	67	13.775	3080	10
24	12.815	3079	15	68	16.767	3082	9
25	26.824	3091	14	69	20.839	3078	9
26	5 – 4.823	3034	10	70	23.748	3079	5
27	8.806	3096	10	71	23.809	3082	9
28	10.806	3075	16	72	25.742	3083	9
29	10.890	3075	21	73	27.728	3069	7
30	24.852	3073	16	74	30.770	3082	7
31	26.805	3102	14	75	11 – 6.751	3081	5
32	6 – 5.819	2963	15	76	10.740	3073	6
33	7.854	3074	14	77	13.814	3077	7
34	14.819	3105	17	78	15.727	3077	6
35	14.874	3114	20	79	17.768	3082	4
36	16.849	3121	11	80	20.755	3078	5
37	16.912	3125	9	81	20.816	3072	9
38	19.841	3076	17	82	22.708	3080	5
39	22.853	3022	14	83	22.769	3073	10
40	23.850	3064	12	84	24.702	3076	5
41	23.893	3040	11	85	24.763	3071	6
42	26.864	3052	8	86	12 – 13.747	3077	4
43	27.882	3090	8	87	15.727	3086	5
44	7 – 3.887	3029	14	88	15.811	3081	6

number r of stars observed each night. Actually (see the fourth article in the present series) this number r represented the weight of ΔT determined astronomically each night by observing a programme worked out to take into account the condition :

$$\frac{\Sigma \tan \delta_r}{r} = \tan \varphi$$

φ being the latitude of the observation point.

The value obtained for the astronomic longitude of the observatory's fundamental point is :

$$\lambda_{NA} = -0^h57^m01^s.3076 \pm 0^s.00037$$

and

$$\varphi_{NA} = +40°51'46''.332 \pm 0''.052$$

12. — GEOGRAPHIC LONGITUDE

Setting up the station on a small pillar that is eccentric in relation to the fundamental point of the Capodimonte Observatory angular measurements were made with a theodolite (with A. PUGLIANO as observer) including sighting of three control points of the Military Geographic Institute in Florence that are part of the Italian geodetic network.

The reductions were made by Engineer Piero BENCINI, Head of the Geodesy Department at the above-mentioned Institute.

The geographic coordinates obtained for the fundamental point are :

$$\varphi = +40°51'46''.844$$
$$\omega = +\ 1°48'11''.888$$

The geographic longitude is related to the Monte Mario meridian, the Italian geodetic network's orientation on the Rome-Monte Mario vertical being defined by the following data :

$$\varphi_{M.M.} = +41°55'25''.51$$
$$\lambda_{M.M.} = 12°27'08''.40 \text{ East of Greenwich}$$
$$\alpha = 6°35'00''.88 \text{ of Monte Soratte}$$

The astronomic longitude of the fundamental point of the Capodimonte Observatory related to the meridian passing through the aforesaid vertical is therefore :

$$\lambda_{NA} = 1°48'11''.214 \text{ to the East of Monte Mario}$$

The difference between the astronomic and the geographic coordinates is accordingly :

$$\Delta\varphi = -0''.512$$
$$\Delta\lambda = -0''.674$$

The coordinates in the Gauss-Boaga system of our fundamental point are :

$$N = 4\,523\,895.58$$

$$E = 2\,457\,265.27$$

In relation to the Camaldoli astronomic station in the Italian geodetic network the azimuth and the distance for our fundamental point are :

$$\alpha = 83^\circ 28' 29''.09$$

$$s = 5388.55$$

Our fundamental point has been entered in the I.G.M.'s Catalogue of trigonometric points with the reference number 184098.