$q = cos.\ 67^\circ . 54'$ et $l q = 9, 5754468$

$l \frac{c}{s} = 3, 8140656$

$l \frac{sq}{c} = 5, 7613812$

subtr. $4, 6855749$

$1, 0758063$

Ergo $\frac{s}{c} q = 12''$

Porro est $l - m = 9, 9700900$

$l \frac{c}{r} = 4, 0201540$

$5, 9499360$

$4, 6855749$

$1, 2643611$

Ergo $- \frac{rm}{c} = 18''$

Ad longitudinem mercurii obſeruatam ob propagationem lucis addi debent $12'' + 18''$ ſeu $30''$, ita vt vera mercurii longitudo in prima obſeruatione ſit

$0 S, 9^\circ, 24', 2''$.

§. 55. Simili modo pro obſeruatione ſecunda correctio ex propagatione lucis orta inueſtigetur.

Longitudo mercurii obſeruata $3 S, 9^\circ, 43', 0''$

Longitudo terrae helioc. $9 S, 27^\circ, 11', 36''$

$5 S, 12^\circ, 31', 24''$

qui arcus eſt $162^\circ, 31', 24''$

vnde erit $\mu = ſin.\ 17^\circ, 28', 36''$

$m = - ſin.\ 72^\circ, 31', 24''$

$l a \mu = 15, 4775000$

$l b = 5, 5878232$

$9, 8896768$

angulus

angulus cuius finus est $\frac{a\mu}{b}$ est 50°, 52′

$q = cos. 50°, 52′, = sin. 39°, 8′$

$lq = 9, 8001169$

$l\frac{c}{r} = 3, 8140656$

5, 9860513

4, 6855749

1, 3004764

Ergo $\frac{r}{c} q = 20''$

Porro $l - m = 9, 9794593$

$l\frac{c}{r} = 4, 0201540$

5, 9593053

4, 6855749

1, 2737304

Ergo $- \frac{r}{c} m = 18'' \frac{3}{4}$

Ad longitudinem mercurii obferuatam addi debent 38″ ita vt vera longitudo mercurii tempore fecundae obferuationis a prima ftella arietis fit

3 S, 9°, 43′, 38″.

§. 56. Pro tertia denique obferuatione correctio ad longitudinem mercurii obferuatam addenda fequenti modo inuenietur.

Longitudo mercurii obferuata.	0 S, 14°, 28′, 14″
Longitudo terrae a 1 * ♈ =	6 S, 17°, 27′, 5″
	5 S, 27°, 1′, 9″

Qui arcus eft 177°, 1′, 9″

vnde μ = fin. 2°, 58′ 51″

et m = − fin. 87°, 1′, 9″

Ia m

$$l a \mu = 14,7163829$$
$$l b = 5,5878232$$
$$9,1285597$$

angulus cuius ſinus $\frac{a\mu}{b}$ eſt, $7^\circ, 44'$

$q =$ coſ. $7^\circ, 44', =$ ſin. $82^\circ, 16'$

$$l q = 9,9960321$$
$$l \frac{c}{s} = 3,8140656$$
$$6,1819665$$
$$4,6855749$$
$$1,4963916$$

Ergo $\frac{s}{c} q = 31\frac{1}{3}''$

Porro eſt $l - m = 9,9994110$

$$l \frac{c}{r} = 4,0201540$$
$$5,9792570$$
$$4,6855749$$
$$1,2936821$$

Ergo $-\frac{r}{c} m = 19\frac{2}{3}''$

Ad longitudinem mercurii obſeruatam addi debent $51''$ ita vt tertia obſeruatione longitudo mercurii fuerit

$$0S, 14^\circ, 29', 5''$$

Haec ita ſe habent, quando mercurius a terra longius diſtat quam ſol: quodſi autem mercurius terrae propior eſſet quam ſol, tum aequatio non erit, vt hic poſuimus $-\frac{r}{c} m + \frac{s}{c} q$ ſed erit $-\frac{r}{c} m - \frac{s}{c} q$. Hoc autem apparebit, ſi cum mercurii locus heliocentricus fuerit inuentus, diſtantia mercurii et terrae heliocentrica minor fuerit quam 90 graduum.

duum. Cum igitur partes aequationis inuenerimus, post modum apparebit, vtrum eae partes addi, an a se inuicem subtrahi debeant; quare plenam correctionem ex propagatione luminis ortam eo vsque differemus, quoad longitudo mercurii heliocentrica fuerit determinata.

§. 57. His praepatatis primam mercurii obseruationem consideremus, atque ad hoc tempus ex tabulis locum mercurii supputemus. Erat igitur

Tempore medio A. 1715 Maï. 9 d. 22 h, 25′, 55″
Longitudo ☿ obseruata a 1 * ♈ = 0 S, 9°, 23, 32″
quae longitudo, si distantia mercurii et terrae heliocentrica maior sit 90°, augeri debet 18″ + 12″. E contrario autem, si haec distantia heliocentrica minor fuerit 90°, augeri debet 18″ − 12″
Latitudo ☿ obseruata est 2°, 23′, 55″ Australis.

Hoc porro tempore inuenta est

Longitudo terrae a 1 * ♈ = 7 S, 0°, 24′, 52″.
Distantia terrae a sole = 101318
Log. distantiae terrae a sole = 5, 0056867.

Deinde ex tabulis mercurii est

Distantia mercurii a sole media a = 38710
Log. huius distantiae seu la = 4, 5878232
Excentricitas orbitae mercurii $k = \frac{205889}{1000000}$
hincque lk = (−1), 3136332
Longitudo Aphelii ☿ a 1 * ♈ p = 7 S, 13°, 48′
Longitudo Nodi asc. q = 0 S, 15°, 42′
Inclinatio orbitae ad Eclipt. n = 6°, 54′.

Iam ex tabulis ad tempus obseruationis supputetur anomalia media.

A. 1701	8 S, 4°, 2′, 0″
Anni 14	1, 14, 6′, 14
Mai.	4, 11, 4, 48
9 d.	1, 6, 49, 52
22 h.	3, 45, 5
25′, 55″	4, 25
	3 S, 9°, 52′, 24″

§. 58. Cum igitur §. 22. anomalia media posita sit x, erit pro hoc tempore $x = 99°, 52', 24''$, ex qua anomalia excentri v reperietur per hanc aequationem $v = x - k$ sin. $(x - k$ sin. $(x - k$ sin. $(x -$ etc.). Cum autem sit $lk = (-1)$. 3136332, atque a logarithmis sinuum subtrahi debeat, 4, 6855749, coniunctim subtrahi debebit 5, 3719417, vt sinus per k multiplicati in arcus conuertantur. Calculus ergo ita se habebit

l sin. $x = 9, 9935285$
$5, 3719417$
$4, 6215868$

k sin. $x = 41839'' = 697'\ 19'' = 11°, 37', 19''$
subtr. ab x $= 99°, 52', 24''$

$x - k$ sin. $x = 88°, 15', 5''$

l sin. $= 9, 9997974$
$5, 3719417$
$4, 6278557$

numerus: $42248'' = 707', 28'' = 11°, 47', 28''$
subtrahatur ab $x = 99°, 52', 24''$
$88°, 4', 56''$

l sin.

$- l$ sin. $= 9, 9997566$
$5, 3719417$
$4, 6278149$

numerus: $42444'' = 707', 24'' = 11°, 47', 24''$
subtr. ab $x = 99°, 52', 24''$
Anomalia excentri $v = 88°, 5', 0'$

Hinc est distantia mercurii a sole $y = a + ak$ cos. v

$l\,a = 4, 5878232$
$l\,k = (-1), 3136332$

$l\,ak = 3, 9014564$
$l$cos. $v = 8, 5243430$

$2, 4257994$

ak cos. $v = 266$
$a = 38710$

$y = 38976$ Distantia mercurii a sole
$ly = 4, 5907973.$

Ex his inuenitur anomalia vera z ope huius aequationis cos. $z = \frac{ak \text{ sin. tot.}}{y} + \frac{a \text{ cos. } v}{y}$, quae praebet hunc calculum

$l\,a\,k$ sin. tot. $= 13, 9014564$
$l\,y = 4, 5907973$

$9, 3106591$

$\frac{ak \text{ sin. tot.}}{y} = 2044839$
l cos. $v = 8, 5243430$
$l\,a = 4, 5878232$

$13, 1121662$
$l\,y = 4, 5907978$

$8, 5213689$

$$\frac{a \cos v}{y} = 332176$$
$$2044839$$

$$\cos. z = 2377015 = \sin. 13^\circ, 45', 3''$$

Ergo anomalia vera $z = 76^\circ, 14', 57''$.

§. 59. Nunc ordo postulat vt in distantiam aphelii a nodo inquiramus, quae posita est e, ex aequatione $\tang. e = \frac{\tang.(p-q)}{\cos. n}$

$$p = 7 S, 13^\circ, 40'$$
$$q = 0 S, 15^\circ, 42'$$
$$p-q = 6 S, 28^\circ, 6' = 208^\circ, 6'$$
$$\tang. (p-q) = \tang. 28^\circ, 6'$$
$$l \tang. (p-q) = 9, 7275008$$
$$l \cos. n = 9, 9968431$$
$$l \tang. e = 9, 7306577 = l \tang\ 28^\circ, 16', 24''$$

Ergo $e = 6 S, 28^\circ, 16', 24'' = 208^\circ, 16', 24''$ qui valor pro omnibus obseruationibus idem manet. Sequitur longitudo planetae a nodo r, estque

$$\tang. r = \cos. n \tang. (e+z)$$
$$e = 6 S, 28^\circ, 16', 24''$$
$$z = 2 S, 16^\circ, 14', 57''$$
$$e+z = 9 S, 14^\circ, 31', 21''$$
$$\tang. (e+z) = -\tang. 75^\circ, 28', 39''$$
$$l - \tang. (e+z) = 10, 5866389$$
$$l \cos. n = 9, 9968431$$
$$l - \tang. r = 10, 5834820$$

Ergo $r = 9 S, 14^\circ, 37', 26''$

Ad longitudinem planetae a nodo r addatur longitudo nodi

nodi a prima ſtella arietis q, et ſumma erit longitudo mercurii heliocentrica a prima ſtella arietis

$$r = 9S,\ 14^\circ,\ 37',\ 36''$$
$$q = 0S,\ 15^\circ,\ 42'$$
$$r + q = 10S,\ 0^\circ,\ 19',\ 36''$$

Cum igitur longitudo terrae ſit $7S,\ 0^\circ,\ 24',\ 52''$ longitudo heliocentrica mercurii a longitudine geocentrica ſubtracta relinquitur

$$0S,\ 9^\circ,\ 23',\ 32''$$
$$10S,\ 0^\circ,\ 19',\ 36''$$
$$2S,\ 9^\circ,\ 3',\ 56''$$

ergo $q = coſ.\ 69^\circ,\ 4'$ et $\frac{s}{c}\,q = 11''$, cum nunc ſit $-\frac{r}{c}\,m = 18''$ erit $\frac{s}{c}\,q - \frac{r}{c}\,m = 29''$; hincque longitudo mercurii obſeruata ob lucis propagationem augeri debet $29''$ etc. vt ea ſit $0S,\ 9^\circ,\ 24',\ 1''$

Latitudo autem heliocentrica s ad boream reſpiciens ex hac aequatione $ſin.\ s = ſin.\ n \cdot ſin.\ (e+z)$ definietur, eſtque $ſin.\ (e+z) = -ſin.\ 75^\circ,\ 28',\ 39''$ vnde

$$l - ſin.\ (e+z) = 9,9858974$$
$$l\ ſin. = 9,0796762$$
$$l - ſin.\ s = 9,0655736$$

ergo $s = -6^\circ,\ 40',\ 42''$; ex quo latitudo heliocentrica mercurii erit auſtralis atque $= 6^\circ,\ 40',\ 42''$.

§. 60. Definito loco heliocentrico pergo ad locum mercurii geocentricum ſupputandum, ad quod erit diſtantia terrae a ſole $c = 101318$

$$l\,c = 5,0056867$$

longitudo terrae $u = 7S,\ 0^\circ,\ 24',\ 52''$

Nunc

Nunc quaeratur angulus $pTV = t$, ex aequatione

$$cot.\ t = cot.\ (u-q-r) - \frac{c}{y\ cos. s\ sin.\ (u-q-r)}$$

Est vero $u = 7S,\ 0°,\ 24',\ 52''$
$q+r = 10S,\ 0°,\ 19',\ 36''$

$u-q-r = 9S,\ 0°,\ 5',\ 16''$
ergo cot. $(u-q-r) = -$ tang. $0°,\ 5',\ 16'' = -15319$

Porro $ly =$	4, 5907973
l cos. $s =$	9, 9974701
l-sin. $(u-q-r) =$	9, 9999994
l-y cos. s. sin. $(u-q-r) =$	24, 5882668
lc (sin. tot.)^3 $=$	35, 0056867
l-y cos. s sin. $(u-q-r) =$	24, 5882668
	10, 4174199
ergo $\frac{-c}{y\ cos. s\ sin. (u-q-r)} =$	26146880
+ cot. $(u-q-r) = -$	15319
cot. $t =$	26131561

Ergo t est $20°,\ 56',\ 27''$ vna cum sex signis, vti conditio problematis requirit, quod figurae repraesentio facile commonstrat. Quare cum sit $t = 6S,\ 20°,\ 56',\ 27''$, hinc longitudo mercurii geocentrica f innotescit ex hac aequatione $f = u - t$

Est vero $u = 7S,\ 0°,\ 24',\ 52''$
$t = 6S,\ 20°,\ 56',\ 27''$
$f = 0S,\ 9°,\ 28',\ 25''$

Actu autem longitudo mercurii ad hoc tempus obseruata est $F = 0S,\ 9°,\ 24',\ 1''$

Ex quo est $F - f = df = -4',\ 24'' = -264''$ qui est error tabularum in longitudine commissus.

§. 61.

§. 61. Latitudo denique Geocentrica g reperietur ex hac aequatione $\text{tang.}\, g = \frac{\text{fin.}\, t \cdot \text{tang.}\, s}{\text{fin.}\, (u-q-r)}$

$$\begin{array}{ll} l - \text{fin.}\, t = & 9,5531590 \\ l - \text{tang.}\, s = & 9,0685182 \\ \hline & 18,6216772 \\ l - \text{fin.}\,(u-q-r) = & 9,9999994 \\ l - \text{tang.}\, g = & 8,6216778 \end{array}$$

Ergo $g = -2^\circ, 23', 46''$. Latitudo ergo Geocentrica erit auftralis atque aequalis $2^\circ, 23', 46''$

Latitudo autem obferuata eft $= 2^\circ, 23', 55''$

Erit ergo $G = -2^\circ, 23', 55''$

$g = -2^\circ, 23', 46''$

Atque $G - g = dg = -9''$.

Qui eft error tabularum in latitudine commiffus.

§. 62. Quod fi nunc, vt fupra fecimus, tabulas ponamus correctas, valores inuenti df et dq per aberrationes tabularum inueniendas dm, dp, dq, dn et dk fequenti modo determinabuntur.

$$df = \frac{(dq+dr)(\text{fin.}\, t)^2}{(\text{fin.}\,(u-q-r))^2} + \frac{acdk\, \text{cof.}\, z (\text{fin.}\, t)^2}{yy\, \text{cof.}\, s. \text{fin.}\,(u-q-r)} - \frac{a^2 ckdm\, \text{fin.}\, v (\text{fin.}\, t)^2}{y^3\, \text{cof.}\, s. \text{fin.}\,(u-q-r)}$$
$$- \frac{cds\, \text{tang.}\, s (\text{fin.}\, t)^2}{y\, \text{cof.}\, s\, \text{fin}\,(u-q-r)} - \frac{c(dq+dr)\, \text{cot.}\, t (u-q-r)(\text{fin.}\, t)^2}{y\, \text{cof.}\, s\, \text{fin.}\,(u-q-r)}$$

$$dg = \frac{ds\, \text{fin.}\, t (\text{cof.}\, g)^2}{(\text{cof.}\, s)^2 \text{fin.}\, (u-q-r)} - \frac{df\, \text{cof.}\, t. \text{tang.}\, s (\text{cof.}\, g)^2}{\text{fin.}\,(u-q-r)} + \frac{(dq+dr)\text{fin.}\, t \cdot \text{tang.}\, s (\text{cof.}\, g)^2}{\text{fin.}\,(u-q-r)\, \text{tang.}\,(u-q-r)}$$

Aequationes autem fubfidiariae funt hae:

$$ds = \frac{dn\, \text{cof.}\, n. \text{fin.}\,(e+z)}{\text{cof.}\, s} + \frac{(de+dz)\, \text{fin.}\, n\, \text{cof.}\,(e+z)}{\text{cof.}\, s}$$

$$dr = \frac{(de+dz)\, \text{cof.}\, n (\text{cof.}\, r)^2}{(\text{cof.}\,(e+))^2} - dn\, \text{fin.}\, n\, \text{tang.}\,(e+z(\text{cof.}\, r)^2$$

$$de = \frac{(dp-dq)(\text{cof.}\, e)^2}{\text{cof.}\, n (\text{cof.}\,(p-q))^2} + \frac{dn\, \text{fin.}\, n\, \text{tang.}\,(p-q)(\text{cof.}\, e)^2}{(\text{cof.}\, n)^2}$$

$$dz = \frac{adm\, \text{fin.}\, z}{y\, \text{fin.}\, v} - \frac{adk\, \text{fin.}\, z}{y} - \frac{dk\, \text{fin}\, z}{1-kk}$$

Quantitatum autem finitarum valores, quae in his formulis insunt, ita se habent

$a = 38710 \;.\; la = 4,5878232$

$c = 101318 \;.\; lc = 5,0056867$

$\frac{1}{1-kk} = \frac{1000000 \cdot 1000000}{794111 \cdot 1205889} \;.\; l\frac{1}{1-kk} = 0,0188112$

$n = 6^\circ, 54'$

$v = 88^\circ, 5'$

$y = 38976. \quad ly = 4,5907973$

$z = 76^\circ, 14', 57''$

$p-q = 6S, 28^\circ, 6'$

$e = 6S, 28^\circ, 16', 24''$

$e+z = 9S, 14^\circ, 31', 26''$

$r = 9S, 14^\circ, 37', 26''$

$s = - \quad 6^\circ, 40', 42''$

$u-q-r = 9S, 0^\circ, 5', 16''$

$t = 6S, 20^\circ, 56', 27''$

$g = -2^\circ, 23', 46''$

§. 63. Quaeramus primum dz ex aequatione:

$$dz = \frac{a\,dm\,\text{fin.}\,z}{y\,\text{fin.}\,v} - \frac{a\,dk\,\text{fin.}\,z}{y} - \frac{dk\,\text{fin.}\,z}{1-kk}$$

vbi notandum est coefficientes ipsius dk in minutis secundis exprimi oportere, quia reliqua differentialia omnia dm, dp, dq, et dn in minutis secundis definiri debent. Erit ergo

$la = 4,5878232$

$l\text{fin.}\,z = 9,9873707$

$14,5751939$

$ly = 4,5907973$

$9,9843966$

$l\text{fin.}\,v$

l sin. v = 9, 9997570

(−1), 9846396 l coeff. dm

numerus = 0, 9652 = coeff. dm

$l\frac{a \sin. z}{y}$ = 9, 9843966

4, 6855749

5, 2988217 = $l\frac{a \sin. z}{y}$ in sec.

$\frac{a \sin. z}{y}$ = 198985″

l sin. z = 9, 9873707

$l\frac{1}{1-kk}$ = 0, 0188112

10, 0061819

4, 6855749

5, 3206070 = $l\frac{\sin. z}{1-kk}$ in sec.

$\frac{\sin. z}{1-kk}$ = 209222″

408207″ = coeff. dk

Ergo $dz = 0, 9652. dm - 408207''. dk$

l0, 9652 = (−1), 9846396

l408207″ = 5, 6108805.

§. 64. Deinde quaeratur expressio, cui de est aequalis ex hac aequatione.

$$de = \frac{(dp - dq)(\cos. e)^2}{\cos. n (\cos. (p-q))^2} + \frac{dn \sin. n \tang. (p-q)(\cos. e)^2}{(\cos. n)^2}$$

l−cos. e = 9, 9448270	l sin. n = 9, 0796762
l(cos. e)^2 = 19, 8896540	$l$tang $(p-q)$ = 9, 7275008
l cos. n = 9, 9968431	l−cos. $(p-q)$ = 9, 9455310
$l$cos. n)^2 = 19, 9936862	l(cos. $(p-q)$)^2 = 19, 8910620

$$l\,(\text{cos. } e) = 19,\ 8896540$$
$$\text{cos. } n = 9,\ 9968431$$
$$19,\ 8928109$$
$$l\,\text{cos.}(p-q))^2 = 19,\ 8910620$$
$$0,\ 0017489$$

coeffic. $(dp-dq) = 1,\ 0040$

Porro l sin. n $= 9,\ 0796762$

$$l\,\text{tang.}\,(p-q) = 9,\ 7275008$$
$$l\,\text{cos.}\,e)^2 = 19,\ 8896540$$
$$38,\ 6968310$$
$$l(\text{cos. } n)^2 = 19,\ 9936862$$
$$(-2),\ 7031448$$

coeff. $dn = 0,\ 0505$

Ergo $de = 1,\ 0040,\ dp - 1,\ 0040\,dq + 0,\ 0505 \cdot dn$

$l1,\ 0040 = 0,\ 0017489$; $l0,\ 0505 = (-2),\ 7031448$

§. 65. Sequitur differentiale ipsius dr ex hac aequatione definiendum:

$$dr = \frac{(de+dz)\,\text{cos. } n\,(\text{cos. } r)^2}{(\text{cos. } (e+z))^2} - dn\ \text{sin. } n \,.\, \text{tang.}\,(e+z)(\text{cos. } r)^2$$

$$l\text{-tang.}(e+z) = 10,\ 5866389$$
$$l\,\text{cos. } r = 9,\ 4022145$$
$$l\,(\text{cos. } r)^2 = 18,\ 8044290$$
$$l\,\text{cos.}\,(e+z) = 9,\ 3992584$$

Ergo l cos. n $= 9,\ 9968431$

$$l\,(\text{cos. } r)^2 = 18,\ 8044290$$
$$28,\ 8012721$$
$$l(\text{cos.}\,(e+2)^2 = 18,\ 7985168$$
$$0,\ 0027553$$

coeff.

coeff. $(de + dz) = 1,0064$
Porro l fin. $n = 9,0796762$
l — tang. $(e+z) = 10,5866389$
$l(\text{cof.}\, r)^2 = 18,8044290$

$(-2),4707441$

coeff. $-dn = 0,0296$.
Ergo $dr = 1,0064.dz + 1,0064.de + 0,0296.dn$
$l1,0064 = 0,0027553$; $l0,0296 = (-2),4707441$
Valoribus autem ipforum dz et de fubftitutis prodit $dr = 0,9714.dm - 410805''.dk + 1,0104.dp - 1,0104.dq + 0,0804.dn$
$l0,9714 = (-1),9873949$
$l410805'' = 5,6136358$
$l1,0104 = 0,0045042$
$l0.0804 = (-2),9052560$

§. 66. Habetur praeterea haec aequatio:
$$ds = \frac{dn\, \text{cof}\, n.\, \text{fin.}(e+z)}{\text{cof.}\, s} + \frac{(de+dz)\, \text{fin}\, n.\, \text{cof.}(e+z)}{\text{cof.}\, s}$$
l — fin. $(e+z) = 9,9858973$
l cof. $n = 9,9968431$

$19,9827404$
l cof. $s = 9,9974701$

$(-1),9852703$

coeff. $-dn = 0,9667$
Porro l fin. $n = 9,0796762$
l cof. $(e+z = 9,3992584$

$18,4789346$
l cof. $s = 9,9974701$

$(-2),4814645$

coeff.

coeff. $(de + dz) = 0,0303$
Ergo $ds = -0,9667 \cdot dn + 0,0303 \cdot dz + 0,0303 \cdot de$. Subſtitutis autem loco dz et de valoribus erit: $ds = 0,0292 \cdot dm - 12369'' \cdot dk + 0,0304 \cdot dp - 0,0304 \cdot dq - 0,9652 \cdot dn$

$l\, 0,0304 = (-2),4832134$
$l\, 0,0292 = (-2),4661041$
$l\, 12369'' = 4,0923450$
$l\, 0,9652 = (-1),9846173$

§. 67. His praeparatis poterimus tandem definire df ex hac aequatione.

$$df = \frac{(dq + dr)(\sin. t)^2}{(\sin. (u-q-r))^2} + \frac{acdk \cos z (\sin. t)^2}{yy \cos. s. \sin. (u-q-r)} - \frac{a^2 ckdm \sin. v (\sin. t)}{y^3 \cos. s. \sin. (u-q-r)}$$
$$- \frac{cds \tang. s (\sin. t)^2}{y \cos. s. \sin. (u-q-r)} - \frac{c(dq+dr) \cos. (u-q-r)(\sin. t)^2}{y \cos. s. \sin. (u-q-r)}$$

Eſtque $l - \sin. (u-q-r) = 9,9999994$
$l - \cot. (u-q-r) = 21852304$
$l - \sin. t = 9,5531590$
$l \cos. z = 9,3760292$
$l \sin. v = 9,9997570$
$l - y \cos. s \cdot \sin. (u\text{-}q\text{-}r) = 24,5882668$
$l k = (-1),3136332$
Hinc habetur: $l(\sin. t)^2 = 19,1063180$
$l(\int(u-q-r))^2 = 19,9999988$

l coeff. $(dq + dr) = (-1),1063192 : n. = 0,1277$
Porro: $l\, a\, c = 9,5935099$
$l \cos. z = 9,3760292$
$l(\sin. t)^2 = 19,1063180$

$38,0758571$

$ly = 4,5907973$

$33,4850598$

$l-y \cos. s \sin.(u-q-r) = 24,5882668$

$8,8967930$

$4,6855749$

$l \text{ coeff.} - dk = 4,2112181\ n := 16264''$

Porro $l\,ac\,(\sin. t)^2 = 28,6998279$

$l\,a = 4,5878232$

$l\,k = (-1)\ 3136332$

$l \sin. v = 9,\ 9997570$

$42,\ 6010443$

$ly^2 = 9,\ 1815946$

$33,\ 4194467$

$l-y \cos. s \sin.(u-q-r) = 24,\ 5882668 + 10$

$l \text{ coeff.} + dm = (-2),\ 8311799\ n := 0,0678$

Porro $l\,c = 5,\ 0056867$

$l - \text{tang.}\ s = 9,\ 0685182$

$l(\sin. t)^2 = 19,\ 1063180$

$33,\ 1805229$

$l-y \cos. s \sin.(u-q-r) = 24,\ 5882668 + 10$

$l \text{ coeff.} - ds = (-2),\ 5922561\ n = 0,0391$

Denique $lc\,(\sin. t)^2 = 24,\ 1120047$

$l - \cot.(u-q-r) = 7,\ 1852304$

$l-y \cos. s \sin.(u-q-r) = 31,\ 2972351$

$24,\ 5882668$

$l \text{ coeff.} - dq - dr = (-4),\ 7089683\ n := 0,0005.$ Erit

Erit ergo $df = 0,1272 . dq + 0,1272 . dr - 16264'' . dk$
$+ 0,0678 . dm - 0,0391 . ds$

Atque substitutis loco dr et ds valoribus inuentis; erit
$df = 0,1902 . dm - 68035'' . dk + 0,1273 . dp$
$- 0,0001 . dq + 0,0479 . dn$

§. 68. Restat denique vt pari modo alteram aequationem ad hanc obseruationem accommodemus, quae est haec.

$$dg = \frac{ds \, \text{fin.} \, t \, (\text{cof.} g)^2}{(\text{cof.} s)^2 \, \text{fin.} (u-q-r)} - \frac{df \, \text{cof.} \, t \, \text{tang.} \, s \, (\text{cof.} g)^2}{\text{fin.} (v-q-r)} + \frac{(dq+dr) \, \text{fin.} \, t \, \text{tang.} \, s \, (\text{cof.} g)^2}{\text{fin.} (u-q-r) \, \text{tang.} (u-q-r)}$$

l cof. g = 9,9996201

l cof. $g)^2$ = 19,9992402
l − fin. t = 9,5531590

29,5523992
l cof. $s)^2$ = 19,9949402

9,5574590
l-fin. $(u\text{-}q\text{-}r)$ = 9,9999994

l coeff. $+ds$ = (-1),5574596 num: = 0,36096

Porro l − cof. t = 9,9703236
l − tang. s = 9,0685182
l cof. $g)^2$ = 19,9992402

39,0380820
l − fin. $(u-q-1)$ = 9,9999994 + 30
l coeff. $+df$ = (-1),0380826 num: = 0,10916

Deinde l − fin. t = 9,5531590
l − tang. s = 9,0685182
l (cof. $g)^2$ = 19,9992402

38,6209174

l − fin.

$l - \text{sin.}(u-q-r) = 9,9999994$

$28,6209180$

$l - \text{cot.}(u-q-r) = 7,1852304 - 40$

l coeff. $+ dq + dr = (-5), 8061484$ num : $0,00006$

Quamobrem erit.

$dg = 0,36096.ds + 0,10916.df + 0,00006.dq + 0,00006.dr.$

substitutis autem loco dr et ds valoribus inuentis erit

$dg = 0,10916.df + 0,01062.dm - 4491''.dk$
$+ 0,01104.dp - 0,01098.dq - 0,3480.dn$

Cum igitur sit $df = -264''$, et $dg = -9''$, vt supra inuenimus §. §. 60 et 61, erit $0,10916.df = -29''$ atque ex hac prima obseruatione habebuntur istae duae aequationes pro correctione tabularum:

$$-264'' = 0,1902.dm - 68035''dk + 0,1273.dp - 0,0001.dq + 0,0479.dn$$

et

$$20'' = 0,01062.dm - 4491''.dk + 0,01104.dp - 0,01098.dq - 0,3480.dn$$

§. 69. Progrediamur iam ad secundam mercurii obseruationem, quae ita se habet:

Tempore medio A. 1716. Aug. 7 d. 22 h. 45', 6''.

Longitudo ☿ a 1 * ♈ obseruata est 3 S, 9°, 43', 0''
quam ob lucis propagationem postmodum corrigemus.

Latitudo ☿ obseruata fuit: 0°, 13', 30'', Borealis

Pro hoc autem tempore inuenta est

Longitudo terrae a 1 * ♈ = 9 S, 27°, 11', 36'' = u

Distantia terrae a Sole = 101096 = c
vnde $lc = 5,0047340$.

Data, autem, quibus tabulae corrigendae sunt superstructae

 supra

supra §. 57. exhibuimus. Iam ad hoc tempus ex tabulis supputemus anomaliam mediam.

A. 1701	8 S, 4°, 2′, 0″
Anni 15	3, 7, 48, 21
Aug. Mensis	4, 27, 34, 29
ob bissext: 8.d.	1, 2, 44, 19
22 h	3, 45, 5
45′6″	7, 41
	5 S, 16°, 1′, 55″

Erit igitur anomalia media $x = 166°, 1', 55''$ et sin. $x =$ sin. $13°, 58', 5''$. Hinc reperietur anomalia media $v = 162°, 28', 52''$; et ex hac porro distantia mercurii a sole: $l\,ak = 3,9014564$

$l -$ cos. $v. = 9,9793743$

$3,8808307$

ak cos. $v = -7600$

$a = 38710$

Ergo distantia ☿ a Sole $y = 31110$, et $ly = 4,4929000$

Deinde hinc colligitur anomalia vera mercurii, z

$l\,ak$ sin. tot. $= 13,9014564$

$ly = 4,4929000$

$9,4085564$

$\frac{ak \text{ sin. tot.}}{y} = 2561867$

Porr $l -$ cos. $v = 9,9793743$

$l\,a = 4,5878232$

$14,5671975$

$l\,y = 4,4929000$

$10,0742975$

-a

$$-\frac{a \cos. v}{y} = 11865817$$
$$+\frac{a\,k \sin.\,tot.}{y} = 2561867$$

$$\cos.\ z = -\ 9303950 = -\sin. 68°, 29', 49''$$
Ergo $z = 158°, 29', 49''$

§. 70. Distantia aphelii a nodo e manet perpetuo eadem, estque $e = 6\,S, 28°, 16', 24''$. Ex hac vero reperietur longitudo mercurii a nodo tang. $r = \cos.\ n$ tang. $(e+z)$

$$e = 6\,S,\ 28°,\ 16',\ 24''$$
$$z = 5\,S,\ \ 8°,\ 29',\ 49''$$

$$e+z = 0\,S,\ \ 6°,\ 46',\ 13''$$
$$l\ \text{tang.}(e+z) = 9,\ 0745115$$
$$l\ \cos.\ n = 9,\ 9968431$$

$$l\ \text{tang.}\ r = 9,\ 0713546$$
Ergo $r = 0\,S,\ 6°, 43', 18''$
at $q = 0\,S,\ 15°, 42',\ 0''$

$$r+q = 0\,S,\ 22°, 25', 18''$$

quae est longitudo planetae heliocentrica: Latitudo autem heliocentrica ita inuenietur.

$$l \sin.\ (e+z) = 9,0714725$$
$$l \sin.\ n = 9,0796762$$

$$l \sin.\ s = 8,1511487$$

Ergo $s = 0°, 48', 41''$ Latitudo ergo heliocentrica est borealis, atque $= 0°, 48', 41''$. Sic itaque inuentus est locus mercurii heliocentricus ad tempus secundae obseruationis.

§. 71. Antequam hinc ad locum mercurii geocentricum inueſtigandum procedam, correctionem ex propagatione lucis ortam definire conueniet, quae cum ſit $= \frac{s}{c} q - \frac{r}{c}$ atque iam ſupra inuentum ſit $\frac{r}{c} m = -18'' \frac{3}{4}$: quaeratur q

long. ☿ geocentrica $= 3S, 9°, 43', 0''$
long. ☿ heliocentrica $= 0S, 22°, 25', 18''$

diff. $2S, 17°, 17', 42''$

Ergo $q =$ coſ. $77°, 17', 42''$

$lq = 9, 3421190$
ſubtr. $8, 4996405$

$0, 8424785$

Ergo $\frac{s}{c} q = 7''$

Quamobrem longitudo mercurii obſeruata augeri debet $26''$ ita vt ſit vera longitudo mercurii $F = 3S, 9°, 43', 26''$ atque latitudo $G = 0°, 13', 30''$.

§. 72. Vt nunc locum mercurii geocentricum definiamus, quaerendus primum eſt angulus pTV ex hac aequatione cot. $t =$ cot. $(u-q-r) - \frac{c}{y \text{ coſ. } s \text{ ſin. } (u-q-r)}$.

at eſt $u = 9S, 27°, 11', 36''$
$q+r = 0S, 22°, 25', 18''$

$u-q-r = 9S, 4°, 46', 18''$

cot. $(u-q-r) = -$ tang. $4°, 46', 18'' = -834743$

$ly = 4, 4929000$
l coſ. $s = 9, 9999564$
l-ſin. $(u-q-r) = 9, 9984921$

$l-y$

$l\text{-}y \cos s \sin.(u-q-r) = 24, 4913485$
$a\, l(\sin.\text{tot.})^5 = 35, 0047340$

$10, 5133855$

$\frac{-c}{y \cos. s \sin.(u-q-r)} = 32612610$
$+\cot.(u-q-r) = -834743$

$\cot. t = 31777867 = \text{tang. } 72°, 31', 55''$

Ergo $t = 17°, 28', 5''$ vna cum 6 fignis.

Cum igitur inuentus fit valor anguli $pTV = t$; ita longitudo geocentrica reperietur

$t = 6S, 17°, 28', 5''$
$u = 9S, 27°, 11', 36''$

$u-t = 3S, 9°, 43', 31''$

Erit igitur ob $f = u-t$ longitudo geocentrica ex tabulis inuenta $f = 3S, 9°, 43', 31''$

Quare cum vera longitudo hoc tempore ex obferuationibus deducta fit:

$F = 3S, 9°, 43, 26''$

Erit $F - f = df = -5''$.

§. 73. Latitudo g denique geocentrica g obtinebitur ex hac aequatione $\text{tang.} g = \frac{\sin. t \text{ tang. } s}{\sin.(u-q-r)}$

vnde $l\text{-}\sin. t = 9, 4773730$
$l \text{ tang. } s = 8, 1511923$

$17, 6285653$
$l\text{-}\sin.(u-q-r) = 9, 9984921$

$l \text{ tang. } g = 7, 9300732$

 Ergo

Ergo $g = 0°, 14', 40''$ At eſt latitudo
vera $G = 0, 13', 30''$ Quare erit
$G - g = dg = -, 70''$

§. 74. Definiamus nunc ordine valores differentialium dz, de, dr, ds, df et dg. ac primo quidem differentiale dz ad modum §. 63.

$$
\begin{array}{rl}
l\,a = & 4,5878232 \\
l\,\text{ſin.}\,z = & 9,5641341 \\
\hline
& 14,1519573 \\
l\,y = & 4,4929000 \\
\hline
& 9,0590573 \\
l\,\text{ſin.}\,v = & 9,4785956 \\
\hline
l\,\text{coeff.}\,dm = & 0,1804617 \\
\text{coeff.} + dm = & 1,5151
\end{array}
$$

Porro eſt $l\frac{a\,\text{ſin.}\,z}{y} = 9,6590573$

$$
\begin{array}{r}
4,6855749 \\
\hline
4,9734824
\end{array}
$$

Num. in ſecundis = 94077

$$
\begin{array}{rl}
l\ \text{ſin.}\ z = & 9,5641341 \\
l\,\frac{1}{1-kk} = & 0,0188112 \\
\hline
& 9,5829453 \\
& 4,6855749 \\
\hline
& 4,8973704
\end{array}
$$

Numerus in ſecundis = 78954''

$$
\begin{array}{r}
94077 \\
\hline
\end{array}
$$

Coeff. $dk = 173031''$. Ergo

Ergo $dz = 1,5151 \,.\, dm - 173031''.\, dk$

$l\,1,5151 = 0,1804617$

$l\,173031 = 5,2381230$

Deinde de retinet valorem suum vt ante §. 64. $de =$

$1,0040 \,.\, dp - 1,0040 \,.\, dq + 0,0505 \,.\, dn$

$l\,1,0040 = 0,0017489$

$l\,0,0505 = (-2),7031448$

§. 75. Hunc ad modum §. 65 quaeramus dr.

$l\,\text{cos}.\, r = 9,9970045$

$l\,\text{cos}.(e+z) = 9,9969610$

Ergo $l\,\text{cos}.\; n = 9,9968431$

$l\,(\text{cos}.\, r)^2 = 19,9940090$

$29,9908521$

$l\,\text{cos}.(e+z)^2 = 19,9939220$

$(-1),9969301 = l$ coeff. $(de + dz)$

$l\,\text{sin}.\; n = 9,0796762$

$l\,\text{tang}.(e+z) = 9,0745115$

$l\,(\text{cos}.\, r)^2 = 19,9940090$

$(-2),1481967$

coeff. $- dn = 0,01406$

Ergo $dr = 1,5045 \,.\, dm - 171812''.\, dk + 0,99696 \,.$

$dp - 0,99696 \,.\, dq - 0,03606 \,.\, dn$

$l\,1,5045 = 0,1773918$	$l\,0,99696 = (-1),9986790$
$l\,171812'' = 5,2350531$	$l\,0,03606 = (-2),5570257$

Ad modum §. 66 quaeratur valor ipsius ds vt sequitur

l sin.

l fin. $(e+z) = 9,0714725$
l cof. $n = 9,9968431$

$19,0683156$

l cof. $s = 9,9999564$

l coeff. $dn = (-1),0683592$
coeff. $dn = 0,11704$
l fin. $n = 9,0796762$
l cof. $(e+z) = 9,9969610$

$19,0766372$

l cof. $s = 9,9999564$

l coeff. $(de+dz) = (-1),0766808$

Ergo $ds = 0,18078 . dm - 20644''. dk + 0,1198. dp - 0,1198 . dq + 0,12306 . dn$

$l\,0,18078 = (-1),2571425$
$l\,20644'' = 4,3148038$
$l\,0,1198 = (-1),0784297$
$l\,0,12306 = (-1),0901170$

§. 76. His praemiffis determinetur valor ipfius df fecundum §. 67:

$l(\text{fin.}\,t)^2 = 18,9547460$
$l(\text{fin.}(u-q-r))^2 = 19,9969842$

$(-2),9577618$

coeff. $+dq+dr = 0,09073$
l ac $= 9,5925572$

l –

$l - \text{cof.}\, z = 9,\ 9686688$
$l(\text{fin.}\, t)^2 = 18,\ 9547460$

$38,\ 5159720$
$l\, y = 4,\ 4929000$

$34,\ 0230720$
$l\text{-}y\, \text{cof.}\, s\, \text{fin.}\, (u-q-r) = 24,\ 4913485$

$9,\ 5317235$
$4,\ 6855749$

$l\, \text{coeff.} + d\, k = 4,\ 8461486$
$\text{coeff.} + d\, k = 70169''$
$l\, \text{ac}\, (\text{fin.}\, t)^2 = 28,\ 5473032$
$l\, a = 4,\ 5878232$
$l\, k = (-1),\ 3136332$
$l\, \text{fin.}\, v = 9,\ 4785956$

$41,\ 9273552$
$l - y^2\, \text{cof.}\, s\, \text{fin.}\, (u-q-r) = 33,\ 4771485$

$l\, \text{coeff.} + d\, m = (-2),\ 4502067$
$\text{coeff.} + d\, m = 0,\ 02819$
$l\, c = 5,\ 0047340$
$l\, \text{tang.}\, s = 8,\ 1511923$
$l(\text{fin.}\, t)^2 = 18,\ 9547460$

$32,\ 1106723$
$-y\, \text{cof.}\, s.\, \text{fin.}\, (u-q-r) = 24,\ 4913485$

$l\, \text{coeff.} + d\, s = (-3),\ 6193238$
$l\, c\, (\text{fin.}\, t)^2 = 23,\ 9594800$

$l -$ cot. $(u-q-r) = 8,9215526$

$32,8710326$

$l - y$ cof. s fin. $(u-q-r) = 24,4913485$

$(-2),3796841$

coeff. $- dq - dr = 0,02397$

coeff. $+ dq + dr = 0,09073$

coeff. $+ dq + dr = 0,06676$ log. $= (-2),8245163$

Ergo $df = 0,1294 . dm + 58612''. dk + 0,0670. dp - 0,00028 . dq - 0,0019 . dn$

§. 77. Reftat denique valor dg, ex §. 68. inueniendus

$l(\text{cof. } g)^2 = 19,9999922$

$l -$ fin. $t = 9,4773730$

$29,4773652$

$l(\text{cof. } s)^2 = 19,9999128$

$9,4774524$

$l -$ fin. $(u-q-r) = 9,9983921 - 10$

l coeff. $+ ds = (-1),4789603$

$l -$ cof $t = 9,9794958$

l tang. $s = 8,1511923$

$l(\text{cof. } g)^2 = 19,9999922$

$38,1306803$

$l -$ fin. $(u-q-r) = 9,9984921 + 30$

$(-2),1321882$

coeff. $- df = 0,01356$

$l-$

$l -$ fin. t (cof. $g)^2 = 29, 4773652$
l tang. $s = 8, 1511923$
$l -$ cot. $(u-q-r) = 8, 9215526$

$46, 5501101$
$l -$ fin. $(u-q-r) = 9, 9984921 + 40$

l coeff. $- dq - dr = (-4), 5516180$
coeff. $- dq - dr = 0, 00036.$

Hinc itaque prodit

$dg = -0, 01356 . df + 0, 0539 . dm - 6158''. dk$
$+ 0, 03574 . dp - 0, 0361 . dq + 0, 3708 . dn.$

Cum nunc fit $df = -5''$ et $dg = -70''$
habebuntur ex obferuatione fecunda hae duae aequationes:
$-5'' = 0, 1294 . dm + 58612''. dk + 0, 0670 .$
$dp - 0, 00028 . dq - 0, 0019 . dn$
et
$-70'' = 0, 0539 . dm - 6158''. dk + 0, 0357 . dp$
$- 0 . 0361 . dq + 0, 03708 . dn.$

§. 78. Refidua eft vltima obferuatio, quae ita fe habet:

Tempore medio A. 1717. April. 25 d. h. 33′, 7″
Longitudo ☿ a 1 ✳ ♈ obferuata eft 0 S, 14°, 28′, 14″
Latitudo ☿ obfernata eft 0°, 18′, 30′. Auftralis.

Pro hoc autem tempore inuenta eft
Longitudo terrae a 1 ✳ ♈ : $u = 6$ S, 17°, 27′, 5″
Diftantia terrae a fole $c = 101045$
et $lc = 5, 0045148.$

Ex tabulis igitur assignemus ad hoc tempus anomaliam mercurii mediam:

A. 1701	8 S, 4°, 2′, 0″
Anni: 16	5, 5, 36, 0
April.	0, 8, 18, 36
25 d.	3, 12, 18, 30
23 h	3, 55, 19
35′, 7″	5, 59
	5 S, 4°, 16′, 25″

Est ergo $x = 154°, 16', 25''$. et sin. $x =$ sin. 25°, 43′, 35″, vnde inuenitur anomalia excentri v.

l sin. $x = 9, 6375000$
5, 3719417
4, 2655583

num: $= 18431'' = 5°, 7', 11''$
$x = 154°, 16', 25$
149°, 9′, 14″ | 30°, 50′, 46″

l sin. $= 9, 7099000$
5, 3719417
4, 3379583

num. $= 21775'' = 6°, 2', 55''$
$x = 154°, 16', 25''$
148°, 13′, 30″ | 31°, 46′, 30″

l sin. $= 9, 7214684$
5, 3719417
5, 3495267

num.

num. = 22363″ = 6°, 12′, 43″
x = 154°, 16′, 25″

148°, 3′, 42″ | 31°, 56′, 18″

l sin. = 9, 7234607
5, 3719417

4, 3515190

num. = 22475″ = 6°, 14′, 35″
x = 154°, 16′, 25″

148°, 1′, 50″ | 31°, 58′, 10″

l sin. = 9, 7238388
5, 3719417

4, 3518971

num. = 22485″ = 6°, 14′, 45″
x = 154°, 16′, 25″

148°, 1′, 40″ | 31°, 58′, 20″

l sin. = 9, 7238726
5, 3719417

4, 3519309

num. = 22487″ = 6°, 14′, 47″
x = 154°, 16′, 25

v = 148°, 1′, 38″

Ergo anomalia excentri v = 4S, 28°, 1′, 38″
et l sin. v = 9, 7238793 et
l cos. v = 9, 9285494
$l\,a\,k$ = 3, 9014564

3, 8300058

$+ ak \text{ cos. } v = - 6761$
$a = 38710$

$y = 31949$ et $ly = 4,5044573$

$la k \text{ sin. tot.} = 13,9014564$
$ly = 4,5044573$

$9,3969991$

$\frac{ak \text{ sin. tot.}}{y} = 24\ 94589$

Porro $l - \text{cos.} v = 9,9285494$
$la = 4,5878232$

$14,5163726$
$ly = 4,5044573$

$10,0119153$

$\frac{-a \text{ cos.} v}{y} = 10278160$

$\frac{ak \text{ sin. tot.}}{y} = 2494589$

$\text{cos. } z = - 7783571 = - \text{sin. } 51°, 6', 38''$

vnde $l - \text{cos. } z = 9,8911799$

Ergo $z = 4S, 21°, 6', 38''$

et $l \text{ sin. } z = 9,7978349$

§. 79 Pergamus ad longitudinem mercurii a nodo, r definiendam:

$e = 6S, 28°, 16', 24''$
$z = 4S, 21°, 6', 38''$

$e + z = 11S, 19°, 23', 2''$
$l - \text{tang.} (e+z) = 9,2728529$
$l \text{ cos. } n = 9,9968431$

$l \text{ tang.} - r = 9,2696960$

Ergo

Ergo $r = 11 S, 19°, 27', 32''$
$q = 0 S, 15°, 42', 0''$

$r + q = 0 S, 5°, 9', 32''$
quae est longitudo mercurii heliocentrica.
Longitudo ☿ geocentrica 0 S, 14°, 28', 14''
- - - - - - heliocentrica 0 S, 5°, 9', 32''

9°, 18', 42''

Ergo ad correctionem a lucis propagatione oriundam est
$q = \text{cof. } 9°, 18', 42''$
et $l q = 9, 9942537$
$l \frac{c}{s} = 3, 8140656$

6, 1801881
4, 6855749

1, 4946132

Ergo $\frac{s}{c} = 31''$ et $-\frac{r}{c} m = 19''$. Ergo longitudo obseruata augeri debet 56'', ita vt ea futura fit
$F = 0 S, 14°, 29', 4''$

§. 80. Latitudo heliocentrica s obtinebitur ad modum §. 59. ex aequatione fin. s = fin. n. fin $(e + z)$
At est l — fin. $(e + z) = 9, 2653550$
l fin. $n = 9, 0796762$

l - fin. $s = 8, 3450312$
Ergo $s = -1°, 16', 5''$
Quare latitudo heliocentrica est australis, atque
$= 1°, 16', 5''$.

§. 81

§. 81. Ad locum geocentricum mercurii definiendum ſequamur operationes §. 60. inſtitutas.

$$u = 6\,S.\ 17^\circ,\ 27',\ 5''$$
$$q+r = 0\,S,\ 5^\circ,\ 9',\ 32''$$
$$u-q-r = 6\,S,\ 12^\circ,\ 17',\ 33''$$
$$\cot(u-q-r) = \text{tang. } 77^\circ,\ 42',\ 27'' = 45893023$$

Porro $l\,y = 4,5044573$

l coſ $s = 9,9998937$

l — ſin. $(u-q-r) = 9,3281807$

$23,8325317 = l - y$ coſ. s ſin. $(u-q-r)$

lc (ſin. tot.)$^2 = 35,0045148$

$11,1719831$

$$\frac{-c}{y\ \text{coſ.}\ s\ \text{ſin.}\ (u-q-r)} = 148587800$$
$$\cot.(u-q-r) = 45893023$$
$$\cot. t = 194480823$$
$$l \cot. t = 11,2888767 = l\ \text{tang. } 87^\circ,\ 3',\ 2''$$

et $t = 2^\circ, 56', 58''$ vna cum 6 ſignis: ex quo ita longitudo geocentrica prodibit

$$u = 6\,S,\ 17^\circ,\ 27',\ 5''$$
$$t = 6\,S,\ 2^\circ,\ 56',\ 58''$$
$$u-t = 0\,S,\ 14^\circ,\ 30',\ 7'' = f.$$

Haecque eſt longitudo geocentrica, quam tabulae praebent, quae cum obſeruata comparata dabit valorem ipſius df.

$$F = 0\,S,\ 14^\circ,\ 29',\ 4''$$
$$f = 0\,S,\ 14^\circ,\ 30',\ 7''$$
$$F-f = -1',\ 3'' = -63'' = df.$$

qui eſt error tabularum in longitudine commiſſus. §.

§. 82. Latitudo geocentrica g ita inuenietur secundum §. 61.

l – sin. t = 8, 7114246
l – tang. s = 8, 3451375

17, 0565621
l – sin $(u-q-r)$ = 9, 3281807

l – tang. g = 7, 7283814
Ergo g = – 0°, 18′, 24″ latitudo geocentrica
At est G = – 0°, 18′, 30″ vnde

G – g = dg = – 6″. error latitudinis.

§. 83. Definiamus nunc ordine valores differentiales dz, dr, ds, df et dg, ac primum dz ad modum §. 63

$l\,a$ = 4, 5878232
l sin. z = 9, 7978349

14, 3856581
$l\,y$ = 4, 5044573

9, 8812008
l sin. v = 9, 7238793

0, 1573215
coeff. dm = 1, 4366
$l\,\frac{a\,\sin.\,z}{y}$ = 9, 8812008
4, 6855749

5, 1950259
num : = 156901″
l sin. z = 9, 7978349

$l\frac{1}{1-kk} = 0,0188112$

$9,8160401$

$4,6855749$

$5,1310712$

num : $= 135229''$

156901

$292130'' =$ coeff. $-dk$

Ergo $dz = 1,4366.dm - 292130''.dk$

$l\,1,4366 = 0,1573215$

$l\,292130'' = 5,4655762$

Atque vt hactenus manet :

$de = 1,0040.dp - 1,0040.dq + 0,0505.dm$

$l\,1,0040 = 0,0017489$

$l\,0,0505 = (-2),7031448$

§. 84. Definiatur nunc differentialis dr valor

$l -$ tang $(e+z) = 9,2728529$

l fin. $n = 9,0796762$

$l(\text{cof. } r)^2 = 19,9852164$

$38,3377455 - 40$

l coeff. $dn = (-2),3377455$

coeff. $dn = 0,02176$

l cof. $n = 9,9968431$

$l(\text{cof. } r)^2 = 19,9852164$

$29,9820595$

$l(\text{cof.}(e+z))^2 = 19,9850042$

l coeff. $de + dz = (-1),9970553$ hincque

dr

$dr = 1,4268 \cdot dm - 290156 \cdot dk + 0,9974 \cdot dp$
$- 0,9974 \cdot dq + 0,0719 \cdot dn$

$l\,1,4268 = 0,1543768$
$l\,290156 = 5,4626315$
$l\,0,9974 = (-1),9988042$
$l\,0,0719 = (-2),8567289$

Porro l-fin. $(e+z) = 9,2653550$
l cof. $n = 9,9968431$

$19,2621981$
l cof. $s = 9,9998937$

l coeff. $-dn = (-1),2623044$
coeff. $-dn = 0,1829$

l cof. $(e+z) = 9,9925021$
l fin. $n = 9,0796762$

$19,0721783$
l cof. $s = 9,9998937$

l coeff. $de+dz = (-1),0722846$ hincque
$ds = 0,16967 \cdot dm - 34503 \cdot dk + 0,1186 \cdot dp$
$- 0,1186 \cdot dq - 0,1770 \cdot dn$

$l\,0,16967 = (-1),2296061$
$l\,34503 = 4,5378608$
$l\,0,1186 = (-1),0740335$
$l\,0,1770 = (-1),2479733.$

§. 85. His praeparatis quaeramus valorem ipsius df

$l(\text{fin. } b)^2 = 17,4228492$
$l(\text{fin } (u-q-r))^2 = 18,6563614$

l coeff. $dq+dr = (-2),7664878$

 coeff.

coeff. $dq+dr$	=	0,05841
$l\,a$	=	4,5870232
$l\,c$	=	5,0045148
l - cos. z	=	9,8911799
$l\,(\sin. t)^2$	=	17,4228492
		30,9003071
$l\,y$	=	4,5044573
		32,4019098
l - y cos. s sin. $(u-q-r)$	=	23,8325317
		8,5693781
		4,6855749
l coeff. + dk	=	3,8838032
coeff. + dk	=	7653''
$l\,ac\,(\sin. t)^2$	=	27,0151872
$l\,ak$	=	3,9014564
l sin. v	=	9,7238793
		40,6405229
$l\,y^3$	=	9,0089146
		31,6316083
l - y cos. s sin. $(u-q-r)$	=	23,8325317 + 10
l coeff. + dm	=	(-3),7990766
coeff. + dm	=	0,0063
$l\,c$	=	5,0045148
l — tang. s	=	8,3451375

l sin.

$l\,(\text{fin.}\ t)^2 = 17,4228492$

$30,7725015$

$l\text{-}y\ \text{cof.}\ s\ \text{fin.}\ (u\text{-}q\text{-}r) = 23,8325317 + 10$

$l\ \text{coeff.} - ds = (-4),9399698$

$l\,c\,(\text{fin}\ t)^2 = 22,4273640$

$l\ \text{cot.}\ (u\text{-}q\text{-}r) = 10,6617465$

$33,0891105$

$l\text{-}y\ \text{cof.}\ s\ \text{fin.}\ (u\text{-}q\text{-}r) = 23,8325317 + 10$

$l\ \text{coeff.} + dq + dr = (-1),2565788$

$\text{coeff.} + dq + dr = 0,14055$

$0,05841$

$\text{coeff.} + dq + dr = 0,23896 : \log. = (-1),3783252$

Ex his inuenitur :

$$df = -63'' = 0,3471.dm - 60074''.dk + 0,2382.dp + 0,00056.dq + 0,01733.dn.$$

§. 86. Restat vt dg definiamus secundum §. 68.

$l\,(\text{cof.}\ g)^2 = 19,9999876$

$l - \text{fin.}\ t = 8,7114246$

$28,7114122$

$l\,(\text{cof.}\ s)^2 = 19,9997874$

$8,7116248$

$l - \text{fin}\ (u - q - r) = 9,3281807$

$l\ \text{coeff.} + ds = (-1),3834441$

$l\,(\text{cof.}\ g)^2 = 19,9999876$

$$l-\text{tang.}\, s = 8,3451375$$
$$l-\text{cos.}\, t = 9,9994244$$
$$38,3445495$$
$$l-\text{sin.}(u-q-r) = 9,3281807 + 30$$
$$l\,\text{coeff.} + df = (-1),0163688$$
$$\text{coeff.} + df = 0,10384$$
$$l(\text{cos.}\, g)^2 - \text{tang.}\, s = 28,3451251$$
$$l-\text{sin}\, t = 8,7114246$$
$$37,0565497$$
$$l-\text{sin.}\,(u-q-r) = 9,3281807$$
$$27,7283690$$
$$l\,\text{cot.}\,(u-q-r) = 10,6617465$$
$$l\,\text{coeff:} - dq - dr = (-2),3901155$$
$$\text{coeff:} - dq - dr = 0,02455$$ hincque
$$dg = -6'' \; 0,10384.df + 0,006.dm - 1219''.dk + 0,0042.dp - 0,0287.dq - 0,0445.dn$$
atque loco df restituto valore $63''$ prodibit
$$0 = 0,006.dm - 1219''.dk + 0,0042.dp - 0,0287.dq - 0,0445.dn$$

§. 87. Ex his igitur tribus obseruationibus, earumque cum tabulis comparatione assecuti sumus sequentes sex aequationes:

I. $-264'' = 0,1902.dm - 68035''.dk + 0,1273.dp - 0,0001.dq + 0,0479.dn$

II. $20'' = 0,01062.dm - 4491''.dk + 0,01104.dp - 0,01098.dq - 0,3480.dn$

III.

III. $-5'' = 0,1294 . dm + 58612'' . dk + 0,0670 . dp$
$- 0,00028 . dq - 0,0019 . dn$

IV. $-70'' = 0,0539 . dm - 6158'' . dk + 0,0357 . dp$
$- 0,0361 . dq + 0,03708 . dn$

V. $-63'' = 0,3471 . dm - 60074'' . dk + 0,2382 . dp$
$+ 0,00056 . dq + 0,01733 . dn$

VI. $0 = 0,006 . dm - 1219'' . dk + 0,0042 . dp$
$- 0,0287 . dq - 0,0445 . dn .$

inter quas aequationes quarta nobis aliquantum ſuſpecta eſſe debet, eo quod orta eſt ex diſcrimine latitudinis obſeruatae, et per tabulas inuentae, ſatis enormi ſcilicet $70''$: quamobrem reliquis quinque aequationibus vti conueniet. Vltima autem aequatio praebet:

$dm = 203166'' . dk - 0,7 . dp + 4,783 . dq + 7,416 . dn$

quae in prima ſubſtituta dat hanc:

$-264'' = -29393'' . dk - 0,0058 dp + 0,9096 . dq + 1,4585 . dn$

ex qua deducitur

$dn = -181'' + 20153'' . dk + 0,00398 dp - 0,62363 dq$

et

$dm = -1342'' + 352622'' . dk - 0,67 dp + 0,158 dq$

Hi valores in aequatione ſecunda ſubſtituti dabunt

$dq = -148'' + 39647'' . dk - 0,01277 . dp$

$dn = -89'' - 4572'' . dk + 0,01194 . dp$

$dm = -1365'' + 358886 . dk - 0,67202 . dp$

In ſubſidium vocentur aequationes tertia et quinta, atque habebitur

$0 = -177'' + 105050'' . dk + 0,01968 . dp$

et

$0 = -410'' + 64439'' . dk + 0,00518 . dp$

ex quibus ſi eliminetur dp, deducetur

dk

$dk = \frac{2771}{349918} = 0,003835$

hincque retrogrediendo obtinebitur

$dp = 10417'' = 2^\circ, 53', 37''$

$dm = -7061'' = -1^\circ, 57', 40''$

$dq = -137'' = - \quad 2', 17''$

$dn = \quad 19'' = + \quad 19''$

§. 88. His igitur correctionibus inuentis Tabulae mercurii sequenti modo se habebunt. Primo scilicet tabula motus medii mercurii, quam assumsimus, vsurpari poterit, verum ab anomalia media ad quoduis tempus ex his tabulis inuenta constanter subtrahi debet $1^\circ, 57', 40''$, ita vt ad initium huius seculi A. 1701 pro meridiano Londinensi fuerit anomalia media mercurii 8 S, $2^\circ, 4', 20''$. Secundo excentricitas orbitae mercurii vera excedit eam, quae in tabulis est assumta, eritque ea $= \frac{209524}{1000000}$ atque huius excentricitatis logarithmus est $= (-1), 3212338$. Tertio longitudo aphelii a prima stella arietis erit $=$ 7 S, $16^\circ, 41', 37''$. Quarto longitudo nodi ascendentis ab eodem termino est $=$ 0 S, $15^\circ, 39', 43''$; et quinto inclinatio orbitae $= 6^\circ, 54', 19''$.

§. 89. Cum nunc hae tabulae correctae cum veritate exactissime consentire debeant, si quidem obseruationes, quibus sum vsus, summa cura sint factae; earum ope ad quod vis tempus locus mercurii verus poterit assignari, isque adeo geocentricus, si tabulae solares supra correctae simul adhibeantur. Quo igitur certitudo harum tabularum tam mercurii, quam solis ad obseruationes examinari queat, inuestigabo per illas transitum mercurii per solem, qui huius anni mense Aprili intra dies 21 et 22 comcontingere debet: quem in finem ante omnia tam loca solis quam mercurii ad meridiem vtriusque diei determinari oportet, vt quo inter illos meridies momento transitus mercurii per solem celebretur, colligi queat: computabo autem haec loca ad tempus medium pro meridiano Londinensi, quia inde conclusio ad quascunque regiones transferri potest.

§. 90. Incipiamus a loco solis, quem ad meridiem cum diei 21 tum 22 Aprilis huius anni 1740 quaeramus, qui annus cum sit bisextilis, dies computari debent 22 et 23. Erit igitur

	Anomalia media solis			
A. 1721	6 S,	13°,	10′,	14″
Anni 19	11,	29,	8,	24
April. d. 22	3,	20,	23,	18
	10,	2°,	41′,	56″
			59′,	8″
April. d. 23.	10,	3°,	41′,	4″

Erit ergo pro meridiano Londinensi et stilo veteri

A. 1740	Anomalia media terrae
meridie Aprilis 21	10 S, 2°, 41′, 56″
meridie Aprilis 22	10 S, 3, 41, 4

Ad has anomalias medias quaerantur iam anomaliae excentri per excentricitatem orbitae terrae correctam methodo supra tradita. Priore nempe die erit $x = 10$ S, 2°, 41′, 56″, atque sin. $x = -$ sin. 57°, 18′, 4″, vnde sequens orietur calculus:

$l - x = 9,\ 9250651$
subtr. $6,\ 4583825$

$3,\ 4666826$
num. $2929'' = 48',\ 49''$
addatur $x = 10\,S,\ 2^\circ,\ 41'\ 56''$

$10\,S,\ 3^\circ,\ 30',\ 45''$
ab $12\,S$

$56^\circ,\ 29',\ 15''$
l — fin. $= 9,\ 9210438$
subtr. $6,\ 4583825$

$3,\ 4626613$
num. $2902'' = 48',\ 22''$
$x = 10\,S,\ 2^\circ,\ 41',\ 56''$

$v = 10\,S,\ 3^\circ\ 30',\ 19''$ anomalia excentri.
Pro sequente meridie est $x = 10\,S,\ 3^\circ,\ 41',\ 4''$, et fin. $x = -$ fin. $56^\circ,\ 18',\ 56''$
l — fin. $x = 9,\ 9201836$
$6,\ 4583825$

$3,\ 4618011$
num. $2896'' = 48',\ 16''$
$x = 10\,S,\ 3^\circ,\ 41',\ 4''$

$10\,S,\ 4^\circ,\ 29',\ 20''$
ab $12\,S$

$55^\circ,\ 30',\ 40''$
l — fin. $= 9,\ 9160516$

$$6 , 4583825$$
$$3 , 4576691$$
num. $2868'' = 47', 48''$
$x = 10\,S, 3^\circ, 41', 4''$
$$10\,S, 4^\circ, 28', 52''$$
$$12\,S$$
$$55^\circ, 31', 8''$$
$l -$ sin. $= 9 , 9160900$
$$6 , 4583825$$
$$3 , 4577075$$
num. $2869'' = 47', 49''$
$x = 10\,S, 3^\circ, 41', 4''$
$v = 10\,S, 4^\circ, 28', 53''$ Anomalia excentri.

§. 91. Hinc ad haec tempora reperitur distantia terrae a sole $y = a + k\,a$ cos. v. At est pro priore meridie cos. $v =$ cos. $56^\circ, 29', 41'' =$ sin. $33^\circ, 30', 19''$;
pro posteriore meridie vero cos. $v =$ cos. $55^\circ, 31', 7'' =$ sin. $34^\circ, 28', 53''$.

Pro priore meridie
l cos $v = 9 , 7419500$
$l\,k\,a = 3 , 2271923$
$$2 , 9691423$$
num. $= 931$.
Ergo distantia terrae a sole $y = 100931$
et $l\,y = 5 , 0040203$.

 Pro

Pro altero meridie

l cos. v = 9, 7529228

$l\ k\ a$ = 3, 2271923

2, 9801151

numerus = 955

Ergo distantia terrae a sole y = 100955

et $l\ y$ = 5, 0041278

§. 92. Anomalia vera z reperietur ex hac aequatione cos. $z = \frac{ka \text{ sin. tot.}}{y} + \frac{a \text{ cos. } v}{y}$

Ergo pro priore meridie

$l\ k\ a$ sin. tot. = 13, 2271923

$l\ y$ = 5, 0040203

8, 2231720

num. = 167175

l cos. v = 9, 7419500

$l\ a$ = 5, 0000000

14, 7419500

$l\ y$ = 5, 0040203

9, 7379297

num. = 5469274

167175

cos. z = 5636449 = sin. 34°, 18′, 29″

Ergo z = 10 S, 4°, 18′, 29″

addatur p = 8 S, 8, 25, 42

longitudo terrae = 6 S, 12°, 44′, 11″ a prima stella arietis, hinc longitudo solis = 0 S, 12°, 44′, 11″ vera

ob

ob lucis propogationem ſubtr. 20″ hinc
longitudo ſolis apparens = 0 S, 12°, 43′, 51″

Pro meridie ſequente.

lka ſin. tot. = 13, 2271923
ly = 5, 0041278
8, 2230645
numerus = 167134

l coſ. v = 9, 7529228
$l\frac{2}{a}$ = 0, 0041278
9, 7487950
num: = 5607833
167134
coſ. z = 5774967 = ſin. 35°, 16′, 29″

Ergo z = 10 S, 5°, 16′, 29″
addatur p = 8, 8, 25, 42
longitudo terrae = 6 S, 13°, 42′, 11″
hinc longitudo ſolis = 0 S, 13°, 42′, 11″ vera
ob lucis propagationem ſubtr. 20″
longitudo ſolis = 0 S, 13°, 41′, 51″ apparens

§. 93. Definitis locis ſolis progrediamur ad mercurii loca inueſtiganda, ac primo quidem anomaliae mediae ita prodibunt ex tabulis correctis.

A. 1721	8 S, 16°, 34′, 20″
19	10, 16′, 42, 21
April.	0, 8, 18, 36
	7 S, 11°, 35′, 17″
d. 22	3, 0, 14, 53
	10 S, 11, 50′, 10″ Anom. media
d. 23	3, 4, 7′, 25
	10 S, 15, 42, 42 Anom. media

Pro priore meridie erit ergo $x = 10\,S, 11^\circ, 50', 10''$ et fin. $x = -$ fin. $48^\circ, 9', 50''$ pro fequente vero meridie $x = 10\,S, 15^\circ, 42', 42''$ et fin. $x = -$ fin. $44^\circ, 17', 18''$

Hinc reperietur anomalia excentri fequenti modo pro priore meridie.

$l -$ fin. $x = 9,8721888$
fubtr. $5,3643411$

$4,5078477$

num : $= 32199'' = 8^\circ, 56', 39''$
$x = 10\,S, 11^\circ, 50', 10''$

$10\,S, 20^\circ, 46', 49''$
ab $12\,S$

$39^\circ, 13', 11''$

$l -$ fin. $= 9,8009204$
$5,3643411$

$4,4365793$

num :

num. = 27326″ = 7°, 35′, 26″
x = 10 S, 11, 50, 10

10 S, 19°, 25′, 36″
ab 12 S

40°, 34′, 24″

l − sin. = 9, 8131944
5, 3643411

4, 4488533
num. = 28110″ = 7°, 48′, 30″
x = 10 S, 11, 50, 10

10 S, 19°, 38′, 40″
ab 12 S

40°, 21′, 20″

l − sin. = 9, 8112592
5, 3643411

4, 4469181
num. = 27984″ = 7°, 46′, 24″
x = 10 S 11, 50, 10

10 S, 19°, 36′, 34″
ab 12

40°, 23′, 26″

l · sin. = 9, 8115712
5, 3643411

4, 4472301

num. = 28005'' = 7°, 46', 45''
x = 10 S, 11, 50, 10

10 S, 19°, 36', 55'',
ab 12 S

40°, 23', 5''

l – sin. = 9, 8115193
5, 3643411

4, 4471782

num: = 28001'' = 7°, 46', 41''
x = 10 S, 11, 50, 10

10 S, 19, 36, 51''
ab 12 S

40°, 23', 9''

l – sin. = 9, 8115288
5, 3643411

4, 4471877

num: = 28002'' = 7°, 46', 42''
x = 10 S, 11, 50, 10

v = 10 S, 19°, 36', 52'' anomalia excentri

Pro sequente meridie
assumatur prior differentia 7°, 46', 42''
x = 10 S, 15, 42, 42

10 S, 23°, 29', 24''
ab 12 S

36°, 30', 36''

l – sin.

$l -$ fin. $= 9,7744899$
$5,3643411$

$4,4101488$
num. $25712'' = 7°, 8', 32''$
$x = 10S, 15, 42, 42$

$10S, 22°, 51', 14''$
ab $12S$

$37°, 8', 46''$
$l -$ fin. $= 9,7806760$
$5,3643411$

$4,4163349$
num. $= 26081'' = 7°, 14', 41''$
$x = 10S, 15, 42, 42$

$10S, 22, 57, 23''$
ab $12S$

$37° 2' 37''$
$-$ fin. $= 9, 7799013$
$5, 3643411$

$4, 4155602$
num. $= 26035'' = 7°, 13', 55''$
$x = 10S, 15, 42, 42$

$10S, 22°, 56', 37''$
ab $12S$

$37°, 3', 23''$
$l -$ fin. $= 9,7800296$
$5,3643411$

$4,4156885$

num. $= 26043'' = 7^\circ, 14', 3''$

$x = 10S, 15, 42, 42$

$10S, 22^\circ, 56', 45''$

ab $12S$

$37^\circ, 3', 15''$

$l-$ fin. $= 9, 7800073$

$5, 3643411$

$4, 4156662$

num. $= 26042'' = 7^\circ, 14', 2''$

$x = 10S, 15, 42, 42$

$v = 10S, 22^\circ, 56', 44''$ anomalia excentri

§. 94. Ex anomalia excentri reperietur primo diftantia mercurii a fole $y = a + ka$ cof. v

Pro priore meridie

cof. $v =$ fin. $49^\circ, 36', 52''$

$la = 4, 5878232$

$lk = (-1), 3212338$

$lka = 3, 9090570$

l cof. $v = 9, 8817849$

$3, 7908419$

ka cof. $v = 6178$

$a = 38710$

$y = 44888$ diftantia Mercurii a fole

$ly = 4, 6521303$

Pro fequente meridie

cof. $v =$ fin. $52^\circ, 56', 44''$

$lka = 3, 9090570$

l cof.

$l\,\text{cos}.\,v = 9,9020390$

$3,8110960$

$ka\,\text{cos}.\,v = 6472$

$a = 38710$

$y = 45182$ distantia Mercurii a sole

$ly = 4,6549654$

§. 95. Nunc reperietur anomalia vera z ex hac aequatione $\text{cos}.\,z = \frac{ka\,\text{sin. tot.}}{y} + \frac{a\,\text{cos}.\,v}{y}$

Pro priore meridie

lka sin. tot. $= 13,9090570$

$ly = 4,6521303$

$9,2569267$

$\frac{ka\,\text{sin. tot.}}{y} = 1806869$

$la = 4,5878232$

$l\,\text{cos}.\,v = 9,8817849$

$14,4696081$

$ly = 4,6521303$

$9,8174778$

$\frac{a\,\text{cos}.\,v}{y} = 6568676$

1806869

$\text{cos}.\,z = 8375545 = \text{sin}.\ 56^\circ,\ 52',\ 57''$

Ergo $z = 10\text{S},\ 26^\circ,\ 52',\ 57''$ anomalia vera

Pro sequente meridie

lka sin. tot. $= 13,9090570$

$ly = 4,6549654$

$9,2540916$

$\frac{ka\,\text{sin. tot.}}{y} = 1795113$

$la =$

$la = 4,5878232$
$l\cos. v. = 9,9020390$

$14,4898622$
$ly = -4,6549654$

$9,8348968$
$\frac{a \cos v}{y} = 6837492$
1795113

$\cos. z = 8032605 = \sin. 59°, 41', 5''$
Ergo $z = 10 S, 29°, 41', 5''$ Anomalia vera.

§. 96. Antequam vlterius progrediamur, necesse est vt in distantiam aphelii a nodo ascendente inquiramus, quae posita est $= e$, et ex hac aequatione inuenitur.
$\tang. e = \frac{\tang. (p-q)}{\cos. n}$
Est vero $p = 7S, 16°, 41', 37''$
$q = 0S, 15°, 39', 43''$

$p-q = 7S, 1°, 1', 54''$
$n = 6°, 54', 19''$
$\tang. (p-q) = \tang. 31°, 1', 54''$
$l \tang. (p-q) = 9,7793173$
$l \cos. n = 9,9968382$

$l \tang. e = 9,7824791 = l \tang. 31°, 12', 58''$
Ergo $e = 7S, 1°, 12', 58''$
Hicque valor est constans, et pro omni tempore idem manet.

§. 97. Sequitur iam determinanda longitudo mercurii a nodo ascendente r per hanc aequationem:
$\tang. r = \cos. n \tang. (e+z)$

Pro

Pro priore meridie

$e = 7S, 1°, 12', 58''$
$z = 10S, 26°, 52', 57''$

$e+z = 5S, 28°, 5', 55''$
tang. $(e+z) = -$ tang. $1°, 54', 5''$
l - tang. $(e+z) = 8, 5211068$
l cos. $n = 9, 9968382$

l - tang. $r = 8, 5179450 = l$ tang. $1°, 53', 15''$
Ergo $r = 5S, 28°, 6', 45''$

Pro sequente meridie

$e = 7S, 1°, 12', 58''$
$z = 10S, 29°, 41', 5''$

$e+z = 6S, 0°, 54', 3''$
l tang. $(e+z) = 8, 1965556$
l cos. $n = 9, 9968382$

l tang. $r = 8, 1933938 = l$ tang. $0°, 53', 39''$
Ergo $r = 6S, 0°, 53', 39''$

§. 98. Quod si ad longitudinem mercurii a nodo r addatur longitudo nodi a prima stella arietis q, obtinebitur mercurii longitudo heliocentrica a prima stella arietis.

Pro primo meridie

$q = 0S, 15°, 39', 43''$
$r = 5S, 28°, 6', 45''$

longitudo $= 6S, 13°, 46', 28''$ mercurii heliocentrica

Pro altero meridie

$q = 0S, 15°, 39', 43''$
$r = 6S, 0°, 53', 39''$

longitudo $= 6S, 16°, 33', 22''$ mercurii heliocentrica

 Lati-

Latitudo autem heliocentrica ad boream respiciens s inuenietur ex hac aequatione $\sin s = \sin. n \sin. (e+z)$ Quare erit

Pro meridie priore.

$\sin (e+z) = \sin. 1^\circ, 54', 5''$
$l \sin. (e+z) = 8, 5208680$
$l \sin. n = 9, 0800068$

$l \sin. s = 7, 6008748 = l \sin. 0^\circ, 13', 43''$
Ergo $s = 0^\circ, 13', 43''$ latitudo heliocentrica.

Pro meridie sequente.

$\sin. (e+z) = - \sin. 0^\circ, 54', 3''$
$l - \sin. (e+z) = 8, 1965020$
$l \sin. n = 9, 0800068$

$l - \sin. s = 7, 2765088 = l \sin. 0^\circ, 6', 30''$
Ergo $s = -0^\circ, 6', 30''$, latitudo heliocentrica australis.

§. 99. Inuentis mercurii locis heliocentricis, pergo ad eius loca geocentrica definienda. Ac primo quidem pro meridie priore erit

Distantia terrae a sole $c = 100931$
et $lc = 5, 0040203$
longitudo terrae $u = 6S, 12^\circ, 44', 11''$
Nunc angulus quaeratur $pTV = t$, ex aequatione

$\cot. t = \cot. (u-q-r) - \frac{c}{y \cos. s \sin. (u-q-r)}$

cum autem sit $u = 6S, 12^\circ, 44', 11''$
subtrahatur $q+r = 6S, 13^\circ, 46', 28''$

erit $u-q-r = 11S, 28^\circ, 57', 43''$
$\tang. (u-q-r) = - \tang. 1^\circ, 2', 17''$

sin.

$\sin.(u-q-r) = -\sin.\ 1°, 2', 17''$
$\cot.(u-q-r) = -551919660$

$lc = 5,0040203$
$ly = 4,6521303$

$30,3518900$
$l\cos.\ s = 9,9999965$

$20,3518935$
$l\sin.(u-q-r) = 8,2580776$

$12,0938159$

$-\frac{c}{y\cos.\ s\sin.\ (u-q-r)} = 1241126000$
$-\ 551919660$

$\cot.\ t\ -\ 689206340 = \text{tang.}\ 89°, 10', 7''$

Ergo $t = 6\ S, 0°, 49', 53''$

Pro sequente meridie

Distantia terrae a sole $c = 100955$
et $lc = 5,0041278$

Longitudo terrae $u = 6\ S, 13°, 42', 11''$
subtr. $q + r = 6\ S, 16°, 33', 22''$

$u-q-r = 11\ S, 27°, 8', 49''$

$\cot.(u-q-r) = -\text{tang.}\ 87°, 8', 49''$
$\sin.(u-q-r) = -\sin.\ 2°, 51', 11''$
$\cot.(u-q-r) = -\ 200657567$

$lc = 5,0041278$
$ly = 4,6549654$

$30,3491624$

cos.

l cos. $s = 9, 9999992$

$20, 3491632$

l-sin.$(u-q-r)$ $8, 6970069$

$11, 6521563$

$- \frac{c}{y \cos. s \sin. (u-q-r)} = - 448907000$

$- 200657567$

cot. $t = 248249433 =$ tang. $87^\circ, 41', 35''$

Ergo $t = 6$ S, $2^\circ, 18', 25''$

§. 100. Ex his reperitur longitudo mercurii geocentrica $= u - t$. Quare erit

Pro priori meridie

$u = 6$ S, $12^\circ, 44', 11''$
$t = 6$ S, $0^\circ, 49', 53''$

$u - t = 0$ S, $11^\circ, 54', 18''$ quae est longitudo mercurii geocentrica a prima stella arietis.

Pro sequenti meridie

$u = 6$ S, $13^\circ, 42', 11''$
$t = 6$ S, $2^\circ, 18', 25''$

$u - t = 0$ S, $11^\circ, 23', 46''$ quae est longitudo mercurii geocentrica.

Latitudo autem geocentrica g, orietur ex hac aequatione tang. $g = \frac{\sin. t. \tang. s}{\sin. (u-q-r)}$

Ergo pro priori meridie

l - sin. $t = 8, 1616658$
l tang. $s = 7, 6008779$

$15, 7625437$

l—

l - fin. $(u - q - r) = 8,2580776$

l tang. $g = 7,4044661 = l$ tang. $0°, 8', 44''$

Ergo latitudo geocentrica $= 0°, 8', 44''$ Borealis

pro altero meridie.

l - fin. $t = 8,6047970$

l - tang. $s = 7,2765095$

$15,8813065$

l - fin. $(u - q - r) = 8,6970069$

l - tang. $g = 7,1842996 = l$ - tang, $0°, 5', 15''$

Ergo latitudo geocentrica $= 0°, 5', 15''$ Auſtralis.

§. 101. Longitudines iſtae inuentae geocentricae ſunt verae, in quibus mercurius conſpiceretur, ſi lumen in inſtanti propagaretur: quamobrem eae ad longitudines apparentes per ſequentem aequationem reducentur.

Pro primo meridie

longitudo ☿ geocentrica $= 0S, 11°, 54', 18''$

longitudo ☿ heliocentrica $= 6S, 13°, 46', 28''$

$6S, 1°, 52', 10''$

l - cof. $1°, 52' = l - q = 9,9997720$

$l\frac{c}{s} = 3\ 8140656$

$6,1857064$

$4,6855749$

$1,5001315$

Ergo $\frac{s}{c} q = -32''$

longitudo ☿ geocentrica $= 0 S, 11^{\circ}, 54', 18''$
longitudo terrae $6 S, 12^{\circ}, 44', 11''$

$6 S, 0^{\circ}, 49', 53$

$l \cdot \text{cos}. 0^{\circ}, 50' = l \cdot m = 9, 9999541$
$l \frac{c}{n} = 4, 0201540$

$5, 9798001$
$4, 6855749$

$1, 2942252$

Ergo $- \frac{n}{c} m = 20''$
$+ \frac{s}{c} q = - 32''$

Aequatio $= - 12''$
quae 12'' a longitudine obseruata subtrahi deberent; et hanc ob rem ad longitudinem veram mercurii addi debebunt. Quocirca priori meridie fuit apparens mercurii longitudo $= 0 S, 11^{\circ}, 54', 30''$.

Pro sequente meridie

longitudo ☿ geocentrica $= 0 S, 11^{\circ}, 23', 46''$
longitudo ☿ heliocentrica $= 6 S, 16^{\circ}, 33', 22''$

Differentia $= 6 S, 5^{\circ}, 9', 36''$

$l \text{ cos. diff.} = l \cdot q = 9, 9982433$
$l \frac{c}{s} = 3, 8140656$

$6, 1841777$
$4, 6855749$

$1, 4986028$

$\frac{s}{c} q = - 31'', 5$

longi-

longitudo ☿ geocentrica = 0 S, 11°, 23′, 46″
longitudo terrae = 6 S, 13°, 42′, 11″

Diff. 6 S, 2°, 18′, 25″
l cos. diff. $= l - m =$ 9, 9996500
$l\frac{c}{r}$ = 4, 0201540

5, 9794960
4, 6855749

1, 2939211

Ergo $-\frac{r}{c}\,m = +$ 19″ 6
$+\frac{s}{c}\,q = -$ 31″, 5

Aequatio = − 12″.

Longitudo ergo geocentrica inuenta augeri debebit 12″, vnde longitudo mercurii apparens pro sequente meridie prodibit = 0 S, 11°, 23′, 58″

§. 102. His inuentis erit ad meridiem diei 21 Aprilis A. 1740 tempore medio sub meridiano Londinensi, vt sequitur.

Longitudo solis apparens 0 S, 12°, 43′, 51″
Longitudo ☿ geocentrica 0 S, 11°, 54′, 30″
Latitudo mercurii geocentrica 0°, 8′, 44″ Borealis.

At ad meridiem diei sequentis, qui est 22 Aprilis tempore medio sub meridiano Londinensi pariter erit

Longitudo solis apparens 0 S, 13°, 41′, 51″
Longitudo ☿ geocentrica 0 S, 11°, 23′, 58″
Latitudo ☿ geocentrica 0°, 5′, 15″ australis.

Vt inueniatur tempus coniunctionis ☉ et ☿, quo longitudines vtriusque fient aequales, apparet primum coniunctionem ante meridiem diei 21 Aprilis contingere debere.

 Nam-

Namque excessus longitudinis solis super longitudinem mercurii isto meridie est 49′, 21″, sequenti vero meridie est excessus 2°, 17′, 83″. Tempore ergo 24 horarum mercurius a sole secundum longitudinem recedit per 1°, 28′, 32. Hinc inueniri poterit tempus ante meridiem diei 21 Aprilis, quo ☿ a sole per spatium 49′, 21″ iam recessit per regulam auream

$1°, 28', 32'' : 24^b = 49', 21'' : 13^b, 22'$

sub meridiano Londinensi ergo coniunctio ☿ cum sole continget Aprilis die 20 : 10^b, 38′ ideoque nocte cum sol iam occidit, ex quo haec coniunctio Londini non erit conspicua. Hic autem Petropoli haec coniunctio incidet in diem 21 Aprilis mane 0^b. 58′, hoc est mox post mediam noctem, tempore ciuili. Verum Obdorae, quo Cel. De l' Isle Noster huius coniunctionis causa est profectus, haec coniunctio incidet in eundem diem 21 Aprilis secundum tempus ciuile mane 3^b, 18′ quo tempore isto loco sol iam supra horizontem versatur: ita vt ista coniunctio Obdorae conspicua esse debeat.

§. 103. Videamus iam, an in hac coniunctione ☿ vere in discum solis intret, et quousque se in solem immergere debeat. Ex locis computatis autem patet, latitudinis mutationem tempore 24 horarum esse 13′, 59″, vnde tempore 13^b. 22′ mutatio latitudinis erit 7′, 47″. Tempore igitur coniunctionis mercurii et solis, latitudo mercurii erit 16′, 31″; vix igitur ac ne vix quidem mercurius solis discum attinget, quia latitudo mercurii minor non est, quam semidiameter solis apparens. Hoc autem intelligendum, quando spectator in centro terrae versaretur: quod si is autem in loco boreali constituatur, vbi hoc

tem-

tempore ſolem prope horizontem cernit, propter parallaxin latitudo mercurii aliquantulum minor ipſi apparebit, atque differentia exſurget prope ad 8″. Quamobrem Obdorae, vbi haec coniunctio, ſole horizontem tenente, contingit; latitudo mercurii apparebit 16′, 23″. vnde ſi diameter ſolis apparens maior fuerit 32′, 46″, mercurius per ſolis diſcum tranſire conſpicietur. Tabulae autem Aſtronomicae apparentem diametrum ſolis hoc tempore maiorem non oſtendunt quam 32′, ex quo concludendum eſt mercurium in hac coniunctione extra limbum ſolis verſari debere. Scilicet momento coniunctionis, quo mercurius et centrum ſolis eandem tenent longitudinem; poſt coniunctionem autem, quia latitudo mercurii decreſcit ſingulis horis 35″, vna hora poſt coniunctionem latitudo mercurii erit 15′, 48″; atque tum mercurius ſecundum longitudinem a centro ſolis diſtabit 3′, 41″, in qua diſtantia ſolis latitudo adhuc maior quam 15′, 34″. Quod ſi autem inueſtigemus, quam prope poſt coniunctionem mercurius ad centrum ſolis accedat, inueniemus minimam diſtantiam eſſe 16′, 11″, idque Obdorae, vbi ſol prope horizontem hoc tempore ſpectatur, atque per parallaxin latitudo mercurii apparens diminuitur, quae diſtantia cum adhuc maior ſit, quam ſemidiameter ſolis apparens, ſequitur omnino ſecundum iſtas tabulas correctas, quibus ſum vſus, mercurium per diſcum ſolis non eſſe tranſiturum.

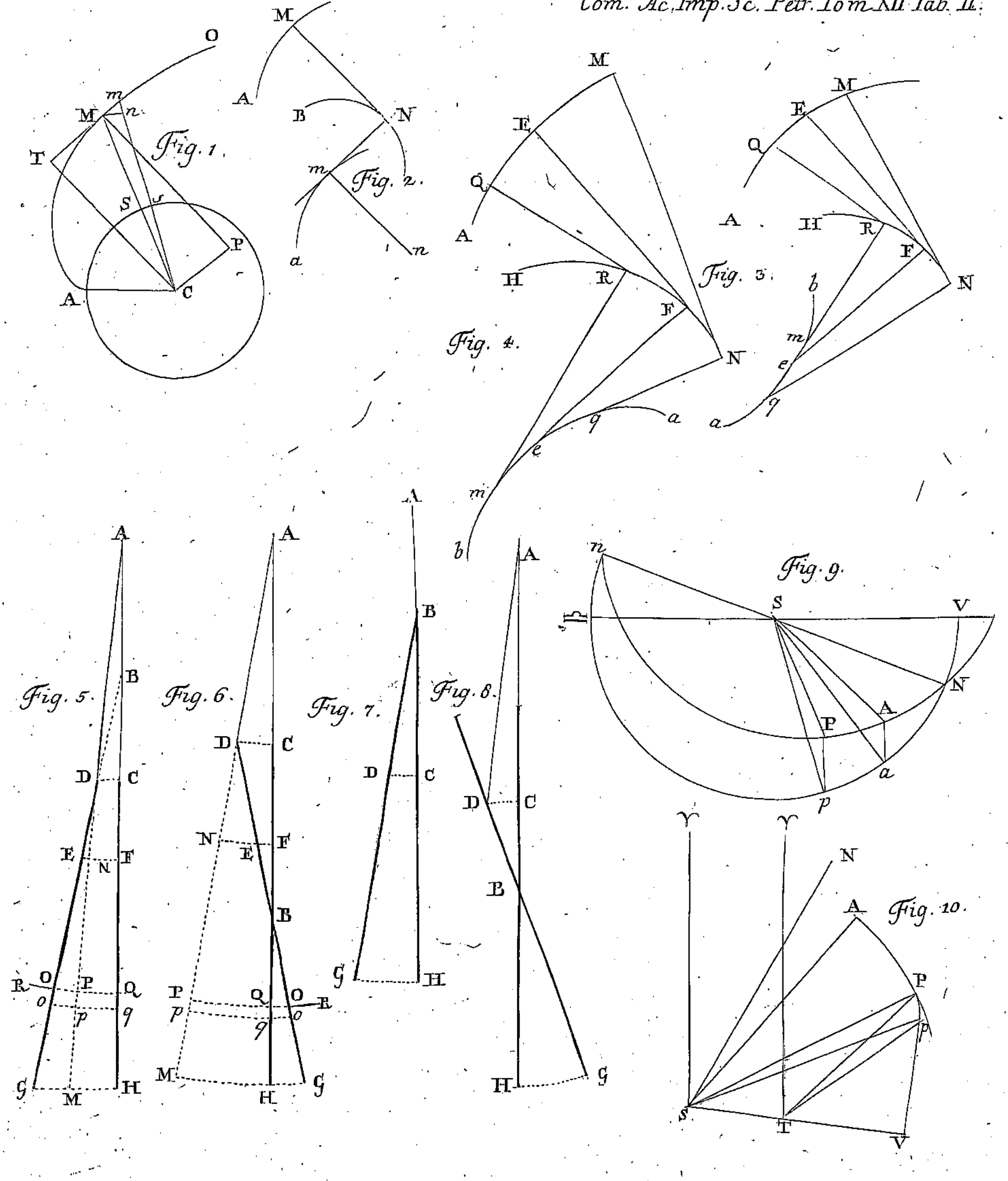
Fig. 1.
Fig. 2.
Fig. 3.
Fig. 4.
Fig. 5.
Fig. 6.
Fig. 7.
Fig. 8.
Fig. 9.
Fig. 10.