

KG

11366

4903



Volume XXVII

Plates

1452

1453

1462



1911phae.proj.1  
PRINCE

ATORY

PRINCETON, N. J.

U. S. A.

PRINCETON UNIVERSITY OBSERVATORY

PRINCETON, N. J.

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Harvard Lunar Plates.

Measures and Reductions

Mary Fowler.

Volume ~~XXVII~~

| Plate No. | Date        | Page |
|-----------|-------------|------|
| 1452      | 1911 Dec. 2 | 1    |
| 1453      | 1911 Dec 2  | 11   |
| 1462      | 1911 Dec 4  | 20   |



| MC1452 |          | Stars - measures |          | 1913 June 21 |          |
|--------|----------|------------------|----------|--------------|----------|
|        | $\alpha$ | $\delta$         | $\alpha$ | $\delta$     | $\alpha$ |
| 1      | 14945    | 15555            | 16140    | 18252        |          |
| 10.5   | 710998   | 1339088          | 1150104  | 1286961      |          |
| 22.8   | 00       | 81               | 01       | 66           |          |
| mag    | 31       | 44               | 30       | 46           |          |
| 7.0    | 22.7832  | 7833             | 10.5367  | 5381         |          |
| 2      |          |                  |          |              |          |
| 23.8   | 19570    | 15599            | 14380    | 15260        |          |
| 15.7   | 1197070  | 1318885          | 1261210  | 699908       |          |
| mag    | 80       | 86               | 13       | 00           |          |
| 8.0    | 55       | 85               | 68       | 49           |          |
|        | 15.7582  | 7590             | 258234   | 8247         |          |
| 3      |          |                  |          |              |          |
| 24.4   | 1350605  | 7704             | 18520    | 14479        |          |
| 26.9   | 06       | 714744           | 1164546  | 1132026      |          |
| mag    | 12940    | 45               | 38       | 20           |          |
| 8.0    |          |                  | 00       | 70           |          |
|        | 26.9434  | 9441             | 24.3137  | 3154         |          |

not very round images.

Exposure grade 3 or 4



VIC1452

Stars - measures

1913 Jan VI

$\alpha$  7  
 $\delta$  14945  
 $\mu$  710998  
 $\sigma$  00  
 $\eta$  31  
 $\zeta$  227832

$\alpha$  15555  
 $\delta$  1339088  
 $\mu$  81  
 $\sigma$  44

$\alpha$  16140  
 $\delta$  1150104  
 $\mu$  01  
 $\sigma$  30

$\alpha$  18252  
 $\delta$  1286961  
 $\mu$  66  
 $\sigma$  46  
 $\zeta$  5351

$\alpha$  1957  
 $\delta$  11971  
 $\mu$  80  
 $\sigma$  55  
 $\zeta$  157582

$\alpha$  13506  
 $\delta$  06  
 $\mu$  12940  
 $\sigma$  80  
 $\zeta$  269434

measure  
 another  
 star  
 if possible

$\alpha$  15260  
 $\delta$  699908  
 $\mu$  0009  
 $\sigma$  49  
 $\zeta$  8247  
 $\alpha$  14479  
 $\delta$  1132026  
 $\mu$  20  
 $\sigma$  70  
 $\zeta$  3154

not on

VIC1452

Stars - Headlines

1913 Jan 21

|      | $\alpha$       | $\delta$ | $\alpha$    | $\delta$ | $\alpha$      | $\delta$ | $\alpha$    | $\delta$ |
|------|----------------|----------|-------------|----------|---------------|----------|-------------|----------|
| 6    | 14945          |          | 15555       |          | 16140         |          | 18252       |          |
| 10.5 | 710998         |          | 1339088     |          | 1150104       |          | 1286961     |          |
| 22.8 | 00             |          | 81          |          | 01            |          | 66          |          |
| mag  | 31             |          | 44          |          | 30            |          | 46          |          |
| 70   | <u>227832</u>  |          | <u>7833</u> |          | <u>105367</u> |          | <u>5381</u> |          |
| 2    |                |          |             |          |               |          |             |          |
| 23.8 | 19570          |          | 15599       |          | 14380         |          | 15260       |          |
| 15.7 | 1197070        |          | 1318885     |          | 1261210       |          | 699908      |          |
| mag  | 80             |          | 86          |          | 13            |          | 00          |          |
| 80   | 55             |          | 85          |          | 68            |          | 49          |          |
|      | <u>15.7582</u> |          | <u>7590</u> |          | <u>288234</u> |          | <u>8247</u> |          |
| 3    |                |          |             |          |               |          |             |          |
| 24.9 | 1350605        |          | 7704        |          | 18520         |          | 14479       |          |
| 26.9 | 06             |          | 714744      |          | 1164546       |          | 1132026     |          |
| mag  | 12940          |          | 45          |          | 38            |          | 20          |          |
| 80   |                |          |             |          | 00            |          | 70          |          |
|      | <u>269434</u>  |          | <u>9441</u> |          | <u>243137</u> |          | <u>3154</u> |          |

not very round images.



MC 1452

Moon Measures

1913 June 21

2

|      | d              | N            |
|------|----------------|--------------|
| 1    | 17475          | 19345        |
| 18.0 | 1576080        | 110255       |
| 20.2 | 5057           | 30           |
|      | 70             | 35           |
|      | <u>20.1712</u> | <u>.1690</u> |

4 min in q = app. 20.1670

|      |                |              |
|------|----------------|--------------|
| 2    | 16550          | 18270        |
| 17.0 | 13055          | 11750        |
| 20.4 | 5145           | 4060         |
|      | 46             | 60           |
|      | <u>20.3500</u> | <u>.3486</u> |

3  
16.2  
21.0

|                |              |
|----------------|--------------|
| 16510          | 17565        |
| 8258           | 1579800      |
| 5554           | 90           |
| 95             | 50           |
| <u>16.1758</u> | <u>.1773</u> |

4 scratch.

|      |                |              |
|------|----------------|--------------|
| 15.9 | 18975          | 16602        |
| 21.5 | 14435          | 1115060      |
|      | 3039           | 70           |
|      | 67             | 00           |
|      | <u>21.4535</u> | <u>.4559</u> |

5  
15.8  
22.0

|                |              |
|----------------|--------------|
| 15230          | 17808        |
| 1441506        | 86155        |
| 10             | 11           |
| 20             | 95           |
| <u>15.9181</u> | <u>.9182</u> |

|                |              |
|----------------|--------------|
| 18481          | 15980        |
| 1618068        | 825858       |
| 70             | 558          |
| 60             | 65           |
| <u>15.7697</u> | <u>.7712</u> |

min in q = app. 15.7510

6  
15.9  
23.0

|                |              |
|----------------|--------------|
| 17383          | 16066        |
| 1620610        | 722829       |
| 90             | 27           |
| 67             | 52           |
| <u>15.8821</u> | <u>.8826</u> |



MC 1452

1913J... 21

2

Moon Measures

|     | a              | N           |
|-----|----------------|-------------|
| 1   | 17475          | 19345       |
| 180 | 15760.80       | 11025.25    |
| 202 | 5057           | 30          |
|     | 70             | 35          |
|     | <u>20.1712</u> | <u>1690</u> |

|     |                        |
|-----|------------------------|
| 2   | min in y = app. 201670 |
| 2   | 16550                  |
| 170 | 13055.45               |
| 204 | 51                     |
|     | 46                     |
|     | <u>203500</u>          |

|      |  |
|------|--|
| 3    |  |
| 16.2 |  |
| 21.0 |  |

4 scratch

|      |                |             |
|------|----------------|-------------|
| 15.9 | 18975          | 16602       |
| 21.5 | 14435.39       | 11150.60    |
|      | 30             | 70          |
|      | 67             | 00          |
|      | <u>21.4535</u> | <u>4559</u> |

|      |  |
|------|--|
| 5    |  |
| 15.8 |  |
| 22.0 |  |

|               |             |
|---------------|-------------|
| 16510         | 17565       |
| 8258          | 15798.80    |
| 5554          | 90          |
| 95            | 50          |
| <u>161758</u> | <u>1773</u> |
| 15230         | 17808       |
| 14415.06      | 8615.5      |
| 10            | 11          |
| 20            | 95          |
| <u>159181</u> | <u>9182</u> |
| 18481         | 15980       |
| 16180.68      | 8258.58     |
| 70            | 55          |
| 60            | 65          |
| <u>157697</u> | <u>7712</u> |

min in x = app. 157510

|      |  |
|------|--|
| 6    |  |
| 15.9 |  |
| 23.0 |  |

|               |             |
|---------------|-------------|
| 17383         | 16066       |
| 16206.10      | 7226.29     |
| 90            | 27          |
| 67            | 52          |
| <u>158821</u> | <u>8826</u> |



1111452 Moon Measures.

d y

$$\begin{array}{r} 7 \\ 16.6 \\ 24.0 \end{array}$$

$$\begin{array}{r} 8 \\ 17.0 \\ 24.3 \end{array} \begin{array}{r} 15681 \\ 13780 \\ 8294 \\ 76 \\ \hline 24.1895 \end{array}$$

$$\begin{array}{r} 13329 \\ 518090 \\ 9290 \\ 24 \\ \hline 1862 \end{array}$$

1913 June 21

3

d

x

v

$$\begin{array}{r} 18262 \\ 1486971 \\ 70 \\ 50 \\ \hline 6612 \end{array}$$

$$\begin{array}{r} 15300 \\ 8725 \\ 25 \\ 45 \\ \hline 6624 \end{array}$$



A101452 known measures

d 9

$$\begin{array}{r} 7 \\ 166 \\ \hline 240 \end{array}$$

$$\begin{array}{r} 8 \\ 170 \quad 15681 \\ 243 \quad 13780 \quad 94 \\ \quad 82 \\ \quad 76 \\ \hline 241895 \end{array}$$

$$\begin{array}{r} 13329 \\ 518090 \\ \quad 92 \\ \quad 24 \\ \hline 1862 \end{array}$$

1913 June 21

d

v

$$\begin{array}{r} 18262 \\ 1486971 \\ \quad 70 \\ \quad 50 \\ \hline 6612 \end{array}$$

$$\begin{array}{r} 15350 \\ 8725 \\ \quad 25 \\ \quad 45 \\ \hline 6624 \end{array}$$

3



1952

Standard Coordinates

1913 June 23

Cape No. 253 mag 7.0

Cape No. 273 mag 8.0

Cape No. 274 mag 8.0

|                  |                |                 |                 |                   |                |                 |                 |                     |                |                 |                 |                     |
|------------------|----------------|-----------------|-----------------|-------------------|----------------|-----------------|-----------------|---------------------|----------------|-----------------|-----------------|---------------------|
| C                | 1 <sup>h</sup> | 41 <sup>m</sup> | 50 <sup>s</sup> | 72 <sup>v</sup>   | 1 <sup>h</sup> | 48 <sup>m</sup> | 53 <sup>s</sup> | 48 <sup>v</sup>     | 1 <sup>h</sup> | 49 <sup>m</sup> | 04 <sup>s</sup> | 45 <sup>v</sup>     |
| L                |                |                 |                 | 70                |                |                 |                 | 57                  |                |                 |                 | 734                 |
| E                |                |                 |                 | 69                |                |                 |                 | 51                  |                |                 |                 | 755                 |
| mean             | 1              | 41              | 50              | 70 <sup>v</sup>   | 1              | 48              | 53              | 52 <sup>v</sup>     | 1              | 49              | 04              | 75 <sup>v</sup>     |
| Prece            |                |                 |                 | +34.97            |                |                 |                 | +34.97 <sup>v</sup> |                |                 |                 | +35.10 <sup>v</sup> |
| $\delta$         | 1              | 42              | 25              | 67 <sup>v</sup>   | 1              | 49              | 28              | 44 <sup>v</sup>     | 1              | 49              | 39              | 85 <sup>v</sup>     |
| A                | 1              | 46              | 23              |                   | 1              | 46              | 23              |                     | 1              | 46              | 23              |                     |
| $\Delta-A$       |                | -3              | 57              | 33 <sup>v</sup>   |                | +3              | 05              | 44 <sup>v</sup>     |                | +3              | 16              | 85 <sup>v</sup>     |
| $\sin(\Delta A)$ |                |                 | -23             | 7.32 <sup>v</sup> |                |                 | +18             | 5.43 <sup>v</sup>   |                |                 | +19             | 6.84 <sup>v</sup>   |
| $\log$           |                |                 | 2.37            | 534 <sup>v</sup>  |                |                 | 2.26            | 818 <sup>v</sup>    |                |                 | 2.29            | 412 <sup>v</sup>    |
| $\cos \delta$    |                |                 | 9.99            | 281 <sup>v</sup>  |                |                 | 9.99            | 398 <sup>v</sup>    |                |                 | 9.99            | 200 <sup>v</sup>    |
| $\Sigma$         |                |                 | 0.87            | 539 <sup>v</sup>  |                |                 | 0.76            | 940 <sup>v</sup>    |                |                 | 0.79            | 336 <sup>v</sup>    |
| $\Sigma_0$       |                |                 | -7.50           | 57 <sup>v</sup>   |                |                 | +5.88           | 03 <sup>v</sup>     |                |                 | +6.21           | 39 <sup>v</sup>     |
| $\Sigma_1$       |                |                 | -               | 11                |                |                 | +               | 11                  |                |                 | +               | 10 <sup>v</sup>     |
| $\Sigma$         |                |                 | 10.49           | 32 <sup>v</sup>   |                |                 | 23.88           | 14 <sup>v</sup>     |                |                 | 24.21           | 49 <sup>v</sup>     |
| $\Sigma$         |                |                 | 10.53           | 74 <sup>v</sup>   |                |                 | 23.82           | 40 <sup>v</sup>     |                |                 | 24.31           | 46 <sup>v</sup>     |

$$\Sigma - \Sigma = +442 \quad -574 \quad +997$$

|                   |      |     |                   |     |     |                   |      |     |                   |
|-------------------|------|-----|-------------------|-----|-----|-------------------|------|-----|-------------------|
| C                 | +10° | 20' | 40.3 <sup>v</sup> | +9° | 27' | 37.2 <sup>v</sup> | +10° | 54' | 37.1 <sup>v</sup> |
| L                 |      |     | 40.8              |     |     | 37.3              |      |     | 36.5              |
| E                 |      |     | 39.8              |     |     | 36.8              |      |     | 37.0              |
| mean              | +10  | 20  | 40.3 <sup>v</sup> | +9  | 27  | 37.1 <sup>v</sup> | +10  | 54  | 36.9              |
| Prece             |      |     | +3                |     |     | +3                |      |     | +3                |
| $\delta$          | +10  | 23  | 59.5 <sup>v</sup> | +9  | 30  | 53.1 <sup>v</sup> | +10  | 57  | 52.8 <sup>v</sup> |
| D                 | +10  | 18  | 54.5 <sup>v</sup> | +10 | 18  | 54.5 <sup>v</sup> | +10  | 18  | 54.5 <sup>v</sup> |
| $\delta-D$        |      | +5  | 05.5 <sup>v</sup> |     | -48 | 00.9 <sup>v</sup> |      | +38 | 58.8 <sup>v</sup> |
| $\tan(\delta-D)$  |      |     | +30               |     |     | -28               |      |     | +23               |
| $\log$            |      |     | 2.48              |     |     | 3.45              |      |     | 3.36              |
| $\gamma_0$        |      |     | 9.81              |     |     | 0.79              |      |     | 0.70              |
| $\tan \delta$     |      |     | 9.26              |     |     | 9.22              |      |     | 9.28              |
| $\Sigma_0$        |      |     | 17.50             |     |     | 15.38             |      |     | 15.86             |
| $\gamma_1$        |      |     | 80.67             |     |     | 78.16             |      |     | 79.27             |
| $\gamma_0$        |      |     | +0.65             |     |     | -6.17             |      |     | +5.01             |
| $\gamma_1$        |      |     | +1.17             |     |     | +6.6              |      |     | +8.5              |
| $\gamma$          |      |     | 22.66             |     |     | 15.83             |      |     | 27.02             |
| $\gamma$          |      |     | 22.78             |     |     | 15.75             |      |     | 26.94             |
| $\gamma - \gamma$ |      |     | +1.16             |     |     | -7.20             |      |     | -7.85             |



1952

Stargland Commission

1913 June 23

Cape No 253 my 70

Cape No 273 my 80

Cape No 274 my 90

|        |                |                 |                 |       |                |                 |                 |       |                |                 |                 |       |
|--------|----------------|-----------------|-----------------|-------|----------------|-----------------|-----------------|-------|----------------|-----------------|-----------------|-------|
| C      | 1 <sup>n</sup> | 41 <sup>n</sup> | 50 <sup>n</sup> | 72    | 1 <sup>n</sup> | 48 <sup>n</sup> | 53 <sup>n</sup> | 48    | 1 <sup>n</sup> | 49 <sup>n</sup> | 04 <sup>n</sup> | 75    |
| L      |                |                 |                 | 70    |                |                 |                 | 57    |                |                 |                 | 734   |
| E      |                |                 |                 | 69    |                |                 |                 | 51    |                |                 |                 | 755   |
| mean   | 1              | 41              | 50              | 70    | 1              | 48              | 53              | 52    | 1              | 49              | 04              | 75    |
| Pres   |                |                 |                 | +3497 |                |                 |                 | +3492 |                |                 |                 | +3510 |
| S      | 1              | 42              | 25              | 67    | 1              | 49              | 28              | 44    | 1              | 49              | 39              | 85    |
| A      | 1              | 46              | 23              |       | 1              | 46              | 23              |       | 1              | 46              | 23              |       |
| K-A    |                | -3              | 57              | 33    |                | +3              | 05              | 44    |                | -3              | 16              | 45    |
| sub(A) |                | -23             | 73              | 32    |                | +185            | 43              |       |                | +196            | 84              |       |
| log.   |                | 2375            | 34              | m     |                | 2268            | 18              |       |                | 2294            | 12              |       |
| ws     |                | 999             | 281             |       |                | 999             | 398             |       |                | 999             | 200             |       |
| 3.     |                | 0875            | 39              | ~     |                | 0769            | 40              |       |                | 0793            | 36              |       |
| 3.     |                | -750            | 57              |       |                | +588            | 03              |       |                | +621            | 39              |       |
| 3.     |                | -               | 14              |       |                | +               | 11              |       |                | +               | 10              |       |
| 3      |                | 1049            | 32              |       |                | 2388            | 14              |       |                | 2421            | 49              |       |
| x      |                | 1053            | 74              |       |                | 2382            | 40              |       |                | 2431            | 46              |       |
| x-F    |                | +               | 442             |       |                | -574            |                 |       |                | +               | 997             |       |

|        |         |        |     |     |        |     |     |     |        |     |  |
|--------|---------|--------|-----|-----|--------|-----|-----|-----|--------|-----|--|
| C      | +10     | 20     | 40  | 3   | -9     | 27  | 372 | +10 | 54     | 371 |  |
| L      |         |        | 408 |     |        |     | 373 |     |        | 365 |  |
| E      |         |        | 398 |     |        |     | 368 |     |        | 370 |  |
| mean   | +10     | 20     | 403 | +9  | 27     | 371 |     | +10 | 54     | 369 |  |
| Pres   |         | +3     | 192 |     | +3     | 160 |     |     | +3     | 159 |  |
| S      | +10     | 23     | 595 | +9  | 30     | 531 |     | +10 | 57     | 528 |  |
| D      | +10     | 18     | 54  | +10 | 18     | 54  |     | +10 | 18     | 54  |  |
| S-D    |         | +5     | 055 |     | -48    | 009 |     |     | +38    | 588 |  |
| sub(A) |         | +3055  |     |     | -28811 |     |     |     | +23389 |     |  |
| log.   |         | 248501 |     |     | 345956 | m   |     |     | 336901 |     |  |
| yo     |         | 981616 |     |     | 079071 | m   |     |     | 070016 |     |  |
| tan S  |         | 92637  |     |     | 92242  |     |     |     | 92472  |     |  |
| tan    |         | 17508  |     |     | 15388  |     |     |     | 15867  |     |  |
| yo     |         | 80679  |     |     | 78164  |     |     |     | 79273  |     |  |
| yo     | +0.6549 |        |     |     | -61760 |     |     |     | +50138 |     |  |
| yo     | +       | 117    |     |     | +      | 66  |     |     | +      | 85  |  |
| yo     | 226666  |        |     |     | 158306 |     |     |     | 270222 |     |  |
| yo     | 227832  |        |     |     | 157546 |     |     |     | 269438 |     |  |
| yo-yo  | +1166   |        |     |     | -720   |     |     |     | -      | 285 |  |



MC 1452

1913 June 23.

5

Center of Plate

| $x$                  | $y$                  | R.A.                 | Decl.     |
|----------------------|----------------------|----------------------|-----------|
| 10.5374 <sup>v</sup> | 227832 <sup>v</sup>  | 1 <sup>h</sup> 42 26 | +10 24 00 |
| 23.8240 <sup>v</sup> | 15.7586 <sup>v</sup> | 49 28                | 9 30 53   |
| 24.3146 <sup>v</sup> | 26.9438 <sup>v</sup> | 49 40                | 10 57 53  |
| 58.68                | 65.49                | 21 34                | 30 52 46  |
| 19.56                | 21.83                | 1 <sup>h</sup> 47 11 | +10 17 35 |
| -18                  | -22                  | - 48                 | - 1 19    |
| 1.56                 | 17                   | 1 46 23              | +10 18 54 |
| 31                   | 465                  |                      |           |
| 156                  | 79                   |                      |           |
| 468                  |                      |                      |           |
| 48.36                |                      |                      |           |

$$A = 1^h 46^m 23^s$$

$$D = +10^\circ 18' 54''$$

$$\begin{aligned}
 &20 - 3 - 140.54 & +2x & -2740 \\
 &+442 - 3201 = -2759 + 21 = -2738 & & - +2 \\
 &-574 - 2214 = -2788 + 48 = -2740 & & = 0 \\
 &+997 - 3786 = -2789 + 48 = -2741 & & = -1 \\
 &17.8528 - 3129 & +36 & = 17.8175
 \end{aligned}$$

$$\begin{aligned}
 &y = +1422 & -34 & -3x & -2652 \\
 &+1166 + 1496 = +2662 - 7 = +2655 - 3 = +2652 = 0 \\
 &-720 + 3383 = +2663 - 5 = +2658 - 7 = +2651 = -1 \\
 &-785 + 3453 = +2668 - 8 = +2660 - 7 = +2653 = +1 \\
 &222680 + 2535 & -7 & -5 & = 222158
 \end{aligned}$$

$$\begin{array}{llll}
 \text{Tables} & a = +0.5 & e = -0.9 & a - e = +1.4 & b + a = -0.2 \\
 \text{Observed} & -2.0 & +0.3 & -2.3 & -1.2
 \end{array}$$

$$C = 0 \quad a - e = +3.7 \quad b + a = +1.0$$



MC 1452

1913 June 23

5

Center Plate

2

1

R<sub>0</sub>

Decl

|         |        |                      |           |
|---------|--------|----------------------|-----------|
| 10.5374 | 227832 | 1 <sup>h</sup> 42 26 | +10 24 00 |
| 23.8240 | 157586 | 49 28                | 9 30 53   |
| 24.3146 | 269438 | 49 40                | 10 57 53  |
| 5868    | 6549   | 21 34                | 30 52 46  |
| 1956    | 2183   | 1 <sup>h</sup> 47 11 | +10 17 35 |
| -18     | -2     | -                    | - 1 19    |
| 156     | 17     | 1 46 33              | -10 18 54 |
| 21      | 465    |                      |           |
| 156     | 79     |                      |           |
| 468     |        |                      |           |
| 48.36   |        |                      |           |

$$A - 1' 46'' - 23''$$

$$D + 10'' 18' 54''$$

$$2 - 3 - 140.54$$

$$+ 22$$

$$+ 2740$$

$$+ 442 - 3201 : - 2759 + 21 = - 2738 \quad - + 2$$

$$- 574 - 2214 : - 2788 + 48 = - 2740 \quad : 0$$

$$+ 997 - 3786 : - 2789 + 48 = - 2741 \quad = - 1$$

$$178528 - 3129$$

$$+ 36$$

$$2178275$$

$$y = m + 1422$$

$$- 34$$

$$- 3x$$

$$- 2652$$

$$+ 1166 + 1496 + 2662 - 7 = + 2655 - 3 = + 2652 = 0$$

$$- 720 + 3383 + 2663 - 5 = + 2656 - 7 = + 2651 = - 1$$

$$- 785 + 3453 + 2668 - 8 = + 2660 - 7 = + 2653 = - 1$$

$$222680 + 2535 - 7 - 5 = 222557$$

$$\text{Tables } a_1 + 0.5 \quad a_2 + 0.9 \quad a - a_2 + 1.4 \quad b + a_1 - 0.2$$

$$\text{Observed } - 2.0 \quad + 0.3 \quad - 2.3 \quad - 1.2$$

$$C = 0$$

$$a - a_2 = + 3.7 \quad b + a_2 + 1.0$$



MC1452 Times etc 1913 June 23, 6  
 Exh testas 1911 Dec 2 2<sup>h</sup> 21<sup>m</sup> - 2 33<sup>m</sup>  
 Moon 2 27 15.0 - 2 27 15.2<sup>v</sup>  
 clock slow 0 49.8<sup>v</sup>

H. Sid T 2 28 04.9<sup>v</sup>  
 H. long 4 44 31.04<sup>v</sup>  
 G. scat. 7 12 35.95<sup>v</sup>  
 Sid T. in moon 16 40 50.77<sup>v</sup>  
 Interval 14 31 45.18<sup>v</sup>  
 Reduction 2 22.82<sup>v</sup>  
 G. m. T. 14 29 22.36<sup>v</sup>

R-a Mech.  
 Moon 14<sup>h</sup> 1<sup>h</sup> 45 49.08<sup>v</sup> + 1.0 44 51.2<sup>v</sup>  
 motion in 1<sup>h</sup> = 2.1467<sup>v</sup> 15.442<sup>v</sup>  
 " 29.3727<sup>v</sup> + 1 03.05<sup>v</sup> + 7 33.5<sup>v</sup>  
 Tabular place 1 46 52.13<sup>v</sup> + 1.0 52 24.7<sup>v</sup>

Moon's parallax 59' 01.7<sup>v</sup>  
 semidiameter 16 06.7<sup>v</sup>

= 966.7 934 = 132<sup>v</sup>  
 Augmentation + 14.1 967 = 14.9<sup>v</sup>  
 980.8  
 Grade 3  $\Delta n$  - 0.7  
 Comp. Radius = 980.1<sup>v</sup>

$R = 21010$   
 $a = -2.0$   
 $\Delta R^2 = 2.1005$   
 $R = 20987$   
 $R^2 = 44121$   
 $\Delta R^2 = +16$   
 $R^2 = 44137$   
 $(1+a)R = 21006$   
 $R^2 = 44125$



mic 1452 Times etc 1913 June 23

|            |            |                                |                |
|------------|------------|--------------------------------|----------------|
| Subtotal   | 1911 Dec 2 | 2 <sup>h</sup> 21 <sup>m</sup> | 2 33           |
| moon       | 2          | 27                             | 150 - 2 27 152 |
| clock slow | 0          | 49.8                           |                |

|               |    |    |       |
|---------------|----|----|-------|
| H sid T       | 2  | 28 | 049   |
| H long        | 4  | 44 | 3105  |
| G sid T       | 7  | 12 | 3595  |
| Sid T in moon | 16 | 40 | 50.77 |
| Interval      | 14 | 37 | 45.18 |
| Reduction     |    | 2  | 2282  |
| G in T        | 14 | 29 | 2236  |

|                               |                   |      |       |       |        |
|-------------------------------|-------------------|------|-------|-------|--------|
| moon 14 <sup>h</sup>          | 1 <sup>h</sup> 45 | 4908 | +10   | 44    | 51.2   |
| moon 1 <sup>h</sup> - 2 14 67 |                   |      |       | 15442 |        |
| 29 37 27                      | +1                | 0305 |       | +2    | 32.5   |
| Tabular place                 | 1                 | 46   | 52.53 | +10   | 52 247 |

moon parallax 59' 01.7  
 lunidian 16 06.7

966.2 934 = 132  
 14 p 967 = 4.0  
 9808  
 Grade 3 Δr = -07  
 Comp Radius 980.920

R = 21010  
 = 21005  
 Δr = 1.6 HCR = 21006  
 R = 44123 R = 44125  
 AR = -16  
 R = 44129

| pt. | pos. $\angle$ | resid. |
|-----|---------------|--------|
| 1   | 176.0         | + 112  |
| 2   | 104.0         | - 20   |
| 3   | 232.9         | + 53   |
| 4   | 247.2         | - 82   |
| 5   | 262.7         | - 43   |
| 6   | 290.4         | + 59   |
| 7   | 325.5         | + 64   |
| 8   | 336.0         | + 10   |

| MC 1452 |         | Moon's Center - |               | 1913 July 1.   | 7        |
|---------|---------|-----------------|---------------|----------------|----------|
| $x$     |         | $x - x_0$       | $(x - x_0)^2$ | $R^2$          | $y - c$  |
| 1       | 18.0000 | +0.1474         | 0.0217        | 4.4262         | + 133125 |
| 2       | 17.0000 | -0.8526         | 0.7269        | 44114          | - 1523   |
| 3       | 16.1766 | -1.6760         | 2.8090        | 44186          | + 5749   |
| 4       | 15.9182 | -1.9344         | 3.7419        | 44045          | - 8492   |
| 5       | 15.7704 | -2.0822         | 4.3355        | 44077          | - 5260   |
| 6       | 15.8824 | -1.9702         | 3.8817        | 44168          | + 3931   |
| 7       | 16.6618 | -1.1908         | 1.4180        | 44164          | + 3527   |
| 8       | 17.0000 | -0.8526         | 0.7269        | 44110          | - 1927   |
|         |         |                 |               | $R^2 = 4.4129$ | +94      |
|         |         |                 |               | 37             |          |

|   | $y$     | $y - y_0$ | $\Delta y$ | $(y - y_0)^2$ |
|---|---------|-----------|------------|---------------|
| 1 | 20.1701 | -2.0985   | -2         | 4.4045        |
| 2 | 20.3493 | -1.9193   | -2         | 3.6845        |
| 3 | 21.0000 | -1.2686   | -1         | 1.6096        |
| 4 | 21.4547 | -0.8139   | -1         | 0.6626        |
| 5 | 22.0000 | -0.2686   | 0          | 0.0722        |
| 6 | 23.0000 | +0.7314   | +1         | 0.5351        |
| 7 | 24.0000 | +1.7314   | +2         | 2.9984        |
| 8 | 24.1878 | +1.9192   | +2         | 3.6841        |

approx center

$$x = 17.0 \quad y = 20.3493$$

$$24.1878$$

$$44.5371$$

$$\text{mean } y = 22.2686$$

$$y - \text{mean} = 20.1670$$

$$R = 2.1016$$

$$x - \text{mean} = 15.7510$$

$$\text{mean } x = 17.8526$$

$$\text{Center } \begin{cases} x_0 = 17.8526 \\ y_0 = 22.2686 \end{cases}$$

see page 10



| MC 1452            | Known Center | 1913 July 1   | 7        |
|--------------------|--------------|---------------|----------|
| $x$                | $x - x_0$    | $(x - x_0)^2$ | $R^2$    |
| 1 18.0000 + 0.1474 | 0.0217       | 4.4262        | + 133125 |
| 2 17.0000 - 0.8526 | 0.7269       | 4.4114        | + 1523   |
| 3 16.1766 - 1.6760 | 2.8090       | 4.4186        | + 549    |
| 4 15.9182 - 1.9344 | 3.7419       | 4.4045        | - 5492   |
| 5 15.7709 - 2.0826 | 4.3355       | 4.4077        | - 5260   |
| 6 15.8829 - 1.9702 | 3.8817       | 4.4168        | + 3931   |
| 7 16.6618 - 1.1908 | 1.4180       | 4.4164        | + 5527   |
| 8 17.0000 - 0.8526 | 0.7269       | 4.4110        | - 17927  |
|                    |              | $R^2 = 44089$ |          |
|                    |              | 37            |          |

| $y$                | $y - y_0$ | $(y - y_0)^2$ |
|--------------------|-----------|---------------|
| 1 20.1701 - 2.0985 | -2        | 4.4045        |
| 2 20.3493 - 1.9193 | -2        | 3.6845        |
| 3 21.0000 - 1.2686 | -1        | 1.6096        |
| 4 21.4547 - 0.8139 | -1        | 0.6626        |
| 5 22.0000 - 0.2686 | 0         | 0.0727        |
| 6 23.0000 + 0.7314 | +1        | 0.5351        |
| 7 24.0000 + 1.7314 | +2        | 2.9984        |
| 8 24.1878 + 1.9192 | +2        | 3.6841        |

approx center

$$z = 17.0 \quad y = 20.3493$$

$$24.1878$$

$$44.5371$$

$$\text{mean } y = 22.2686$$

$$y - \text{mean} = 21.670$$

$$R^2 = 21.016$$

$$x - \text{mean} = 15.7510$$

$$\text{mean } x = 17.8526$$

$$\text{Center } \begin{cases} X = 17.8526 \\ Y = 22.2686 \end{cases}$$

see p 10

# Formation of Normals

|   | ab     | au      | bu      |
|---|--------|---------|---------|
| 1 | - 0.31 | + 20.0  | - 27.92 |
| 2 | + 1.63 | + 12.7  | + 28.8  |
| 3 | + 2.13 | - 95.6  | - 72.4  |
| 4 | + 1.56 | + 162.0 | + 68.0  |
| 5 | + 0.54 | + 108.0 | + 13.5  |
| 6 | - 1.44 | - 76.7  | + 28.5  |
| 7 | - 2.06 | - 41.6  | + 60.5  |
| 8 | - 1.63 | + 16.1  | - 36.5  |
|   | + 0.42 | + 104.9 | - 188.8 |

$$at \quad (aa) = +17.66$$

$$(bb) = +17.65$$

$$-4.31 - 6.10 = +9.1$$

$$-6.09 + 4.31 = +3$$

$$+6.09 + 8.60 = -12.4$$

$$+12.91 = -12.5$$

$$-4.31 + 9.1 = 5.9 = +32$$

$$b = -9.7$$

$$a = -7.4$$

MC 1452

change  
Conditional Equations

1913 July 8

8

|   | a     | b     | c       | 0-c   |
|---|-------|-------|---------|-------|
| 1 | +0.15 | -2.10 | = +1.33 | +1.11 |
| 2 | -0.85 | -1.92 | = -1.5  | -3.1  |
| 3 | -1.68 | -1.27 | = +.57  | +5.3  |
| 4 | -1.93 | -0.81 | = -8.4  | -8.1  |
| 5 | -2.08 | -0.27 | = -5.2  | -4.2  |
| 6 | -1.97 | +0.73 | = +3.9  | +5.9  |
| 7 | -1.19 | +1.73 | = +3.5  | +6.1  |
| 8 | -0.85 | +1.92 | = -1.9  | +7    |

Normal Equations

$$+17.66 + 0.42 = +10.5$$

$$+ 0.42 + 17.65 = -1.89$$

$$- 0.42 - 0.01 = -2\frac{1}{2}$$

$$+ 17.64 = -19\frac{1}{2}$$

$$b = -11$$

$$- 0.01 - 0.42 = +4\frac{1}{2}$$

$$+ 17.65 = +109\frac{1}{2}$$

$$a = +6$$

Conditional Equations

|   | a     | b     | c       | 0-c   |
|---|-------|-------|---------|-------|
| 1 | +0.15 | -2.10 | = +1.25 | +1.07 |
| 2 | -0.85 | -1.92 | = -2.3  | -4.1  |
| 3 | -1.68 | -1.27 | = +4.9  | +3.6  |
| 4 | -1.93 | -0.81 | = -9.2  | -10.2 |
| 5 | -2.08 | -0.27 | = -6.0  | -6.5  |
| 6 | -1.97 | +0.73 | = +3.1  | +3.4  |
| 7 | -1.19 | +1.73 | = +2.7  | +4.0  |
| 8 | -0.85 | +1.92 | = -2.7  | -1.1  |

$$-43.1 - 6.10 = +5.9$$

$$-60.9 + 43.1 = -2.9$$

$$+60.9 + 8.60 = -8.3$$

$$+1.291 = -1.12$$

$$b = -8.7$$

$$-4.31 + 5.9 - 5.3 = +6$$

$$a = -1.4$$

$$\text{Average } (b-c) = 5.4$$

1412

Red ad. brown chh.

S<sub>0</sub> + 10 = 21H + α = 3 00:45<sup>0</sup>

H 1 14

α 1 46

G 22 10

G + α 23 56:35<sup>9</sup>

L cos S 99929

S<sub>0</sub> 04478S<sub>0</sub> 04407

L cos S 9.2544

cos(H + α) 98495

L 13065

L 98495

S<sub>0</sub> 00071S<sub>0</sub> 88239

L cos(B + α)

99999

q

12204

Lw

82419m

Lw S

92616

88239

8

12203

9

75478m

L' 04104

L' 99870

L + 226

S - 000

L + 097

L + 323

S' 71661

L' + 257

L' + 276

L' + 2194

NG 1452

1913 July 8

8

## Conditional Equations

|   | $a$    | $b$    | $c$      | $0-c$  |
|---|--------|--------|----------|--------|
| 1 | + 0 15 | - 2 10 | = + 1 33 | + 1 11 |
| 2 | - 0 85 | - 1 42 | = - 1 5  | - 3 1  |
| 3 | - 1 08 | - 1 27 | = + 5 7  | + 5 3  |
| 4 | - 1 93 | - 0 81 | = - 8 4  | - 8 1  |
| 5 | - 2 08 | - 0 27 | = - 5 2  | - 4 2  |
| 6 | - 1 97 | + 0 73 | = + 3 9  | + 5 9  |
| 7 | - 1 19 | + 1 73 | = + 3 5  | + 6 1  |
| 8 | - 0 85 | + 1 92 | = - 1 9  | + 7    |

## Normal Equations

$$\begin{aligned}
 &+ 17.66 + 0.42 + 105 \\
 &+ 0.42 + 17.65 = 189 \\
 &- 0.42 - 6.01 = 2\frac{1}{2} \\
 &\quad + 17.64 = 191\frac{1}{2} \quad b = -11 \\
 &- 6.01 - 0.42 + 4 \\
 &+ 17.65 = 109 \quad a = +6
 \end{aligned}$$

## Conditional Equations

|   | $a$    | $b$    | $c$      | $0-c$  |
|---|--------|--------|----------|--------|
| 1 | + 0 15 | - 2 10 | = + 1 25 | + 1 07 |
| 2 | - 0 85 | - 1 92 | = - 2 3  | - 4 1  |
| 3 | - 1 68 | - 1 27 | = + 4 9  | + 3 6  |
| 4 | - 1 93 | - 0 81 | = - 9 2  | - 1 02 |
| 5 | - 2 08 | - 0 27 | = - 6 0  | - 6 5  |
| 6 | - 1 97 | + 0 73 | = + 3 1  | + 3 4  |
| 7 | - 1 19 | + 1 73 | = + 2 7  | + 4 0  |
| 8 | - 0 85 | + 1 92 | = - 2 7  | - 1 1  |

Average  $0-c = 54$ 

$$-431 - 610 = +59$$

$$-609 + 431 = -29$$

$$+609 + 860 = 1469$$

$$+1291 = -112$$

$$b = -87$$

$$-431 + 59 = 53 = +6$$

$$a = 14$$

1452

Red ad locum alt.

$$S_0 = +10 \quad 21$$

$$H + \alpha \quad 3^{\circ} \quad 00' = 45^{\circ}$$

$$H \quad 1 \quad 14$$

$$\alpha \quad 1 \quad 46$$

$$G \quad 22 \quad 10$$

$$G + \alpha \quad 23 \quad 56 = 359^{\circ}$$

$$\cos(\theta + \alpha) \quad 9.9999$$

$$q \quad 1.2204$$

$$\sin \dots \quad 8.2419m$$

$$\tan S \quad 9.2616$$

$$8.8239$$

$$8' \quad 12203$$

$$9 \quad 75478m$$

$$h \quad +226$$

$$g \quad -0.00$$

$$h \quad +0.97 \checkmark$$

$$+323$$

$$\cos S \quad 9.9929$$

$$i \quad 0.4478$$

$$(i) \quad 0.4407$$

$$\sin S \quad 9.2544$$

$$\cos(H + \alpha) \quad 9.8495$$

$$h \quad 1.3065$$

$$\sin \dots \quad 9.8495$$

$$\sec S \quad 0.0071$$

$$8.8239$$

$$h' \quad 0.4104$$

$$h \quad 9.9870$$

$$g' \quad +1.661$$

$$h' \quad +2.57$$

$$i \quad +2.76 \checkmark$$

$$+2194$$

1452 Moon's Mean Position (1911.0)

9

$$Y_0 = 17.8526''$$

$$\begin{array}{r} 17.8526'' \\ -1 \\ \hline 17.8525'' \end{array}$$

$$Y_0 = 22.2686''$$

$$\begin{array}{r} 22.2686'' \\ -4 \\ \hline 22.2682'' \end{array}$$

from Plate Constants.  $X = 17.8272$   $Y = 22.2553$ 

$$\xi = -0.1728$$

$$\eta = +0.2553$$

$$\log \xi = 9.23754$$

$$\log \tan \delta = 9.2825$$

$$\cos \delta = 9.99288$$

$$\log \xi^2 = 8.4751$$

$$\cos \alpha = 8.50724$$

$$\log \eta = 9.8110$$

$$(\alpha - A) = 0.73742$$

$$\log \eta_0 = 9.46705$$

$$\alpha - A = 5.46$$

$$\cos \alpha = 7.33115$$

$$A = 1^h 46^m 23^s$$

$$(\delta - D) = 2.07590$$

$$\alpha_0 = 1^h 46^m 17.54^s$$

$$\delta - D = +1^{\circ} 59.1'$$

$$D = +10^{\circ} 18' 54''$$

$$\delta_0 = +10^{\circ} 20' 53.1''$$

$$X = 17.8528$$

$$Y = 22.2680$$

from Plate Constants  $X = 17.8175$   $Y_0 = 22.2551$ 

$$\xi = -0.1825$$

$$\eta = +0.2551$$

$$\log \xi = 9.26126$$

$$\log \eta_0 = 9.40671$$

$$\cos \delta = 9.99288$$

$$7.33115$$

$$8.50724$$

$$(\delta - D) = 2.07556$$

$$(\alpha - A) = 0.76114$$

$$\delta - D = +1^{\circ} 59.0'$$

$$\alpha - A = 5.77$$

$$D = +10^{\circ} 18' 54''$$

$$A = 1^h 46^m 23^s$$

$$\delta_0 = +10^{\circ} 20' 53.0''$$

$$\alpha_0 = 1^h 46^m 19.23^s$$

$$\alpha_0 = 1^h 46^m 19.23^s$$



14) 2 known mean Position (1911.0)

9

$$X_0 = 178526 \\ \frac{1}{2} \Delta = \frac{-1}{178525}$$

$$Y_0 = 222686 \\ \frac{1}{2} \Delta = \frac{-4}{222682}$$

from plate constants  $X = 178272$   $Y = 222553$ 

$$Z = -0.1728$$

$$\eta = +02153$$

$$\log Z = 9.23754$$

$$\log \tan S = 9.2825$$

$$\cos S = 9.99288$$

$$\text{const} = 8.50724$$

$$Z = 84751$$

$$\eta = 98110$$

$$(X-A) = 073742$$

$$\eta_0 = 940705$$

$$X-A = 546$$

$$\text{const} = 733115$$

$$A = 1^h 46^m 23^s$$

$$(D-D) = 207590$$

$$Q_0 = 1^h 46^m 17^s.4$$

$$S-D = +1591$$

$$D = +10^{\circ} 18' 54''$$

$$S_0 = +10^{\circ} 20' 53''$$

$$X = 178528$$

$$Y = 22.2680$$

from plate constants  $X = 178175$   $Y = 222551$ 

$$Z = -0.1825$$

$$\eta = +02551$$

$$\log Z = 9.26126$$

$$\log \eta_0 = 9.40671$$

$$\cos S = 9.99288$$

$$733115$$

$$8.50724$$

$$(D-D) = 207556$$

$$(X-A) = 076114$$

$$S-D = +1590$$

$$X-A = 577$$

$$D = +10^{\circ} 18' 54''$$

$$A = 1^h 46^m 23^s$$

$$S_0 = +10^{\circ} 20' 53''$$

$$Q_0 = 1^h 46^m 17^s.23$$

$$\text{const} = 733115$$

$$\text{Rec} = +323$$

$$\text{Rec} = 219$$

## Formation of Normals.

|   | ab     | ac      | bc      |
|---|--------|---------|---------|
| 1 | - 0.31 | + 20.6  | - 288.0 |
| 2 | + 1.63 | + 9.4   | + 21.2  |
| 3 | + 2.13 | - 102.4 | - 77.5  |
| 4 | + 1.56 | + 154.0 | + 64.6  |
| 5 | + 8.56 | + 100.0 | + 13.0  |
| 6 | - 1.44 | - 84.7  | + 31.4  |
| 7 | - 2.06 | - 46.5  | + 67.5  |
| 8 | - 1.63 | + 12.8  | - 288   |
|   | + 0.44 | + 63.2  | - 196.6 |

$$(x - x_0)^2 + (y - y_0)^2 = 0 - C$$

|   |        |       |
|---|--------|-------|
| 1 | 4.4262 | + 137 |
| 2 | 4.4114 | - 11  |
| 3 | 4.4186 | + 61  |
| 4 | 4.4045 | - 80  |
| 5 | 4.4077 | - 48  |
| 6 | 4.4168 | + 43  |
| 7 | 4.4164 | + 39  |
| 8 | 4.4110 | - 15  |

$$R^2 = 4.4125$$

### Conditional Equations

|   | a     | b     | 0      | C             | 0 - C |
|---|-------|-------|--------|---------------|-------|
| 1 | +0.15 | -2.10 | = +137 | +4 + 24 = +25 | +112  |
| 2 | -0.85 | -1.92 | = -11  | -3 + 22 = +19 | -30   |
| 3 | -1.68 | -1.27 | = +61  | -6 + 14 = +8  | +53   |
| 4 | -1.93 | -0.81 | = -80  | -7 + 9 = +2   | -82   |
| 5 | -2.08 | -0.28 | = -48  | -8 + 3 = -5   | -43   |
| 6 | -1.97 | +0.73 | = +43  | -8 - 8 = -16  | +59   |
| 7 | -1.19 | +1.73 | = +39  | -5 - 20 = -25 | +64   |
| 8 | -0.85 | +1.92 | = -15  | -3 - 22 = -25 | +10   |

Average = 57

### Normal Equations

$$\begin{aligned}
 + 17.66a + 0.44b &= +63 \\
 + 0.44a + 17.65b &= -197 \\
 - 0.44a - 0.01b &= -2 \\
 + 17.64a &= -799 \\
 + 17.66a - +63 + 5 &= +68
 \end{aligned}$$

$$b = -11.3$$

$$a = +3.8$$

1452 Linear Parallax

$$\alpha = 1^{\circ} 46' 20.46''$$

$$\delta = 2^{\circ} 26' 04.9''$$

$$\alpha - \alpha' = +41' 44.44''$$

$$+10^{\circ} 26' 07''$$

$$+ 9' 02''$$

$$+10' 22' 05''$$

$$9.95727$$

$$0.00000$$

$$00.0715$$

$$99.6442$$

$$\delta = 42' 39.21''$$

$$10' 21' 15''$$

$$32' 18' 06''$$

$$9.82640$$

$$8.23476$$

$$9.72785$$

$$0.16903$$

$$79.5804$$

$$\delta - \delta' = +31' 12.7''$$

$$\delta = +10' 52' 27.6''$$

$$2.11 -$$

$$\text{cont. Allen } \delta = 2.0' 52' 29.7''$$

$$\delta = 2.0' 52' 29.7''$$

$$0 - \delta$$

$$+2.9$$

$$\delta' = +10^{\circ} 21' 19.9''$$

$$\mu = 59' 0.17''$$

$$9.86913$$

$$8.23476$$

$$9.25798$$

$$0.00787$$

$$73.6974$$

$$\alpha - \alpha' = +8' 03.24''$$

$$+32' 22''$$

$$\delta = 1' 46' 52.68''$$

$$\delta = 1' 46' 52.13''$$

$$+0.55$$

$$(x - \bar{x})^2 + (y - \bar{y})^2$$

|   |           | 0 - C   |
|---|-----------|---------|
| 1 | 4 4 2 6 2 | + 1 3 7 |
| 2 | 4 4 1 1 4 | - 1 1   |
| 3 | 4 4 1 8 6 | + 6 1   |
| 4 | 4 4 0 4 5 | - 8 0   |
| 5 | 4 4 0 7 7 | - 4 8   |
| 6 | 4 4 1 6 8 | + 4 3   |
| 7 | 4 4 1 6 4 | + 3 9   |
| 8 | 4 4 1 1 0 | - 1 5   |

R<sup>2</sup> 4 4 1 2 5

### Conditional Equations

|   | a      | b       | 0         | C                 | 0 - C   |
|---|--------|---------|-----------|-------------------|---------|
| 1 | + 0.15 | - 2 1 0 | = + 1 3 7 | + 6 + 2 4 = + 2 5 | + 1 1 2 |
| 2 | - 0.85 | - 1 9 2 | = - 1 1   | - 3 + 2 2 = + 1 9 | - 3 0   |
| 3 | - 1.68 | - 1 2 7 | = + 6 1   | - 6 + 1 4 = + 8   | + 5 3   |
| 4 | - 1.93 | - 0 8 1 | = - 8 0   | - 7 + 9 = + 2     | - 8 2   |
| 5 | - 2.08 | - 0 2 7 | = - 4 4   | - 8 + 3 = - 5     | - 4 3   |
| 6 | - 1.97 | + 0 7 3 | = + 4 3   | - 8 - 8 = - 1 6   | + 5 9   |
| 7 | - 1.19 | + 1 7 3 | = + 3 9   | - 5 - 2 0 = - 2 5 | + 6 4   |
| 8 | - 0.85 | + 1.92  | = - 1 5   | - 3 - 2 2 = - 2 5 | + 1 0   |

Average = 57

### Normal Equations

$$+ 1.766a + 0.44b = + 63$$

$$+ 0.44a + 1.766b = - 1.97$$

$$- 0.44 = 0.01 = - 2$$

$$+ 1.766b = - 7.99$$

$$b = - 11.3$$

$$+ 1.766a + + 63 + 5 = + 68$$

$$a = + 3.8$$

1452 Lunar Parallax

$$\begin{aligned}
 \alpha &= 1^h 46^m 20.46^s \\
 \theta &= 22^\circ 04.9' \\
 \theta - \alpha &= +41^\circ 44.44' \\
 &= +10^\circ 26' 07''
 \end{aligned}$$

$$\begin{aligned}
 &+ 4^\circ 02' \\
 &+ 10^\circ 22' 05''
 \end{aligned}$$

$$\begin{aligned}
 &9.95727 \\
 &0.00000 \\
 &\hline
 &0.00715 \\
 &9.96442
 \end{aligned}$$

$$\delta = 42^\circ 39' 21''$$

$$10^\circ 21' 15''$$

$$32^\circ 18' 06''$$

$$\begin{aligned}
 &9.82640 \\
 &8.23476 \\
 &9.72785 \\
 &\hline
 &0.16903 \\
 &7.95804
 \end{aligned}$$

$$\delta - \delta' = +31^\circ 12.7'$$

$$S = +10^\circ 52' 27.6''$$

$$\text{Lunar } S = +10^\circ 52' 24.7''$$

$$O - C = +2.9''$$

$$S' = +10^\circ 21' 14.9''$$

$$\Pi = 59' 01.7''$$

$$\begin{aligned}
 &9.86913 \\
 &8.23476 \\
 &9.25795 \\
 &\hline
 &0.00787 \\
 &7.36974
 \end{aligned}$$

$$\alpha - \alpha' = +8' 03.24''$$

$$= +32^\circ 22''$$

$$\alpha = 1^h 46^m 52.68^s$$

$$\alpha = 1^h 46^m 52.13^s$$

$$+0.55''$$

MC 1453

Star - Measurers

1913 June 23

11

|      | d              | N           | d              | N           |
|------|----------------|-------------|----------------|-------------|
| 1    | 18700          | 14956       | 19620          | 14370       |
| 97   | 1367576        | 997576      | 1621815        | 775553      |
| 225  | 7376           | 79          | 15             | 5653        |
|      | 90             | 50          | 10             | 52          |
|      | <u>22.5020</u> | <u>5024</u> | <u>9.6599</u>  | <u>6603</u> |
| 23.0 | 16867          | 18958       | 13842          | 864032      |
| 56   | 1112234        | 1468591     | 1382030        | 32          |
|      | 3031           | 9890        | 1018           | 8610        |
|      | 60             | 48          |                |             |
|      | <u>15.5734</u> | <u>5740</u> | <u>22.9978</u> | <u>9975</u> |
| 3    |                |             |                |             |
| 3.5  | 16220          | 17329       | 166257         | 17430       |
| 4.7  | 859700         | 1494032     | 1068390        | 13340       |
|      | 02             | 37          | 9090           | 3932        |
|      | 63             | 19          | 00             | 10          |
|      | <u>26.7607</u> | <u>7610</u> | <u>23.4078</u> | <u>4085</u> |

Exposure grade 3 or 4



1911phae 22 Star Meanings

1913 June 23

11

| d          | N       | d       | N      |
|------------|---------|---------|--------|
| 1 18700    | 14956   | 19620   | 14370  |
| 97 1367576 | 997576  | 1621815 | 775553 |
| 215 7376   | 79      | 15      | 5653   |
| 90         | 50      | 10      | 52     |
| 125020     | 5024    | 96599   | 6603   |
| 230 16867  | 18958   | 13842   | 864032 |
| 56 1112234 | 1468591 | 1382030 | 32     |
| 3031       | 9890    | 1018    | 8610   |
| 60         | 48      |         |        |
| 155734     | 5740    | 229978  | 9975   |
| 3 16220    | 17329   | 16625   | 17430  |
| 235 859700 | 1494032 | 1068396 | 13340  |
| 02         | 37      | 9090    | 3932   |
| 03         | 19      | 00      | 10     |
| 267607     | 7610    | 234078  | 4085   |



MC1453

Moon-Measures 1913 June 23

12

19060  
 78- 14270  
 20.5 70.70  
 80  
 4 20.4515

16328  
 11118  
 1007  
 14  
 4781

18.170  
 20.6 12010 21  
 40  
 60  
 20.6140

15270  
 11395  
 9000  
 50  
 6133

1.4  
 21.0

17490  
 1097580  
 78  
 80  
 16.3492

16230  
 12720 28  
 30  
 12  
 3498

16616  
 14 1269190  
 8890  
 06  
 21.3922

18697  
 1264015-  
 2028  
 80  
 3934

15.6  
 22.6

17454  
 14650 27  
 30  
 44  
 15.7178

19187  
 1199990  
 94  
 79  
 7189

15.6  
 22.6

15469  
 1180000  
 80  
 45  
 15.6334

18245  
 11894  
 9090  
 40  
 6351

15.7  
 23.0

15372  
 12140 22  
 11  
 50  
 15.6753

17284  
 1050003  
 93  
 72  
 6777



MC 1453

1 MC 1453 - 1913 June 23

12

1 19090  
 178- 14270  
 205 70 70  
 80  
 1 20.4815

16328  
 11118  
 1007  
 14  
 4781

120 18170  
 206 12010 21  
 40  
 60  
 206140

15270  
 11395  
 90  
 50  
 6133

16.4  
 2.0

17590  
 10975 80  
 78  
 80  
 16.3492

16230  
 12720 28  
 30  
 12  
 3498

160 16616  
 178 1269190  
 88  
 06  
 21.3922

18697  
 12640 11  
 2028  
 80  
 3934

157  
 2.0

17454  
 14630 27  
 30  
 44  
 157174

19187  
 11999 90  
 94  
 79  
 7189

156  
 26  
 2.0

15469  
 11800 00  
 80  
 45  
 15.6334

18245  
 11894 90  
 90 90  
 40  
 6351

157  
 23.0

15372  
 12120 22  
 11  
 50  
 156713

17284  
 10500 03  
 93  
 72  
 6777



ML 1453 Moon measures.

1913 June 23

13

$d$        $\gamma$        $v$   
 $\frac{8}{16.3}$   
 $24.0$

$d$        $\alpha$        $v$   
 $16502$        $17018$   
 $836158$        $1513350$   
 $60$        $2750$   
 $92$        $10$   
 $16.1866$        $.1877$

$\frac{9}{17.0}$        $19209.$        $15538$   
 $245$        $13700$        $1105250$   
              $9594$        $4020$   
              $92$        $38$   
 $24.5501$        $.5505$

possibly on terminator

$16.0$        ~~$16520$~~        $16520$   
 $23.8$             $14165$

very oblique.

23.7645 after.



1913 Jan 23

Moon measures

1913 Jan 23

13

$$\begin{array}{r} 8 \\ 16.8 \\ 24.0 \end{array}$$

$$\begin{array}{r} 16502 \\ 836158 \\ 60 \\ 92 \\ \hline 161866 \end{array}$$

$$\begin{array}{r} 17018 \\ 1513350 \\ 2750 \\ 10 \\ \hline 1877 \end{array}$$

$$\begin{array}{r} 9 \\ 170 \\ 245 \\ \hline 19204 \\ 13700 \\ 95-94 \\ 92 \\ \hline 24.5501 \end{array}$$

$$\begin{array}{r} 15538 \\ 1105250 \\ 4030 \\ 38 \\ \hline 55-05 \end{array}$$
possibly in  
— terminal
$$\begin{array}{r} 160 \\ 23.8 \end{array}$$
~~16524~~

$$\begin{array}{r} 16520 \\ 14165 \\ \hline \end{array}$$

237645 appr.

very oblique



ML1453

1913 June 27. 14

## Plate Constants

|                  | 1        | 2        | 3            |
|------------------|----------|----------|--------------|
| x                | 9.6601   | 22.9976  | 23.4082      |
| y                | 10.4925  | 23.8814  | 24.2149      |
| x-3              | - 8324   | - 8838   | - 8067       |
| y                | 22.5022  | 15.5737  | 26.7608      |
| y                | 22.6666  | 15.8306  | 27.0223      |
| y-y              | - 1644   | - 2569   | - 2615       |
| z-3              | - 69.24  | + 2.52   | + 9859       |
| - 8324 - 1557 =  | - 9881   | + 24 =   | - 9857 = +2  |
| - 8838 - 1078 =  | - 9916   | + 57 =   | - 9859 = 0   |
| - 8067 - 1852 =  | - 9919   | + 59 =   | - 9860 = -1  |
| 17.7338 - 1563 = | + 44 =   |          | = 18.5678 ✓  |
| y-y              | + 7.022  | + 1.64   | + 930        |
| - 1644 + 678 =   | - 966    | + 36 =   | - 930 = 0    |
| - 2569 + 1614 =  | - 955    | + 25 =   | - 930 = 0    |
| - 2615 + 1643 =  | - 972    | + 43 =   | - 929 = +1   |
| 225505 + 1245 =  | + 36 =   |          | = 228016 ✓   |
| Tables           | a = +0.7 | e = -0.7 | a - e = +1.4 |
| Obs.             | - 2.5    | - 1.6    | - 0.9        |
| C - 0            |          |          | + 2.3        |
|                  |          |          | + 0.5        |



MC1453

1913 June 23 14

## Plate constant

|               | 1      | 2      | 3      |
|---------------|--------|--------|--------|
| $x$           | 96601  | 229976 | 234082 |
| $y$           | 104925 | 238814 | 242149 |
| $x-y$         | -8324  | -8838  | -8067  |
| $\eta$        | 225022 | 155737 | 267608 |
| $\gamma$      | 226666 | 158306 | 270223 |
| $\eta-\gamma$ | -1644  | -2569  | -2615  |

$$\begin{array}{rclcl}
 2-3 & -69.24 & & +2.52 & +9859 \\
 -8324 & -1557 & -9881 & +24 & -9857 & = +2 \\
 -8838 & -1078 & -9916 & +57 & -9859 & = 0 \\
 -8067 & -1852 & -9919 & +59 & -9860 & = -1 \\
 \hline
 177338 & -1563 & & +44 & & = 185678
 \end{array}$$

$$\begin{array}{rclcl}
 \eta-\gamma & +70.22 & & +1.67 & +930 \\
 -1644 & +678 & -966 & +36 & -930 & = 0 \\
 -2569 & +1614 & -955 & +25 & -930 & = 0 \\
 \hline
 -2615 & +1643 & -972 & +43 & -929 & = +1 \\
 225805 & +1245 & & +36 & & = 228016
 \end{array}$$

$$\begin{array}{rclcl}
 \text{Tables } a & = +0.7 & b & = -0.7 & a-b & = +1.4 & b+a & = -0.5 \\
 \text{Obs} & -2.5 & & -1.6 & & -0.9 & & -1.0 \\
 \\ 
 C-O & & & & & +2.3 & & +0.5
 \end{array}$$



MC1453 Times etc.

1913 June 24.

15

Exp. to stars 1911 Dec 2<sup>h</sup> 38<sup>m</sup> - 2<sup>h</sup> 50<sup>m</sup>  
 .. moon 2 44 10.05 - 2 44 10.2<sup>h</sup>  
 clock slow 0 49.8<sup>v</sup>

H. Sid T. 2 44 59.9<sup>v</sup>  
 H. long 4 44 310.5<sup>v</sup>  
 G. Sid T. 7 29 30.95<sup>v</sup>  
 Sid T. in moon 16 40 50.77<sup>v</sup>  
 Interval 14 48 40.18<sup>v</sup>  
 Reduction 2 25.59<sup>v</sup>  
 G. T. T. 14 46 14.59<sup>v</sup>

From Gun Eph.  
 Tabular Place

R.A.

Decl.

Moon 1.4<sup>h</sup> 1<sup>h</sup> 45<sup>m</sup> 49.68<sup>v</sup> +10° 44' 51.2<sup>v</sup>  
 Motion in 1<sup>m</sup> = 2.1476<sup>v</sup> 15.436<sup>v</sup>  
 .. 46.2432<sup>v</sup> 1 39.31<sup>v</sup> +11 538<sup>v</sup>  
 Tabular Place 1 47 2839<sup>v</sup> +10 56 450<sup>v</sup>

Moon's parallax

59' 02.5<sup>v</sup>

Moon's Semidiameter

16' 06.85<sup>v</sup> = 96.6.85<sup>v</sup>

augmentation = 13.9

934 = 43.0

967 = 13.9

Computed Radius = 980.7

= 2.1023

R<sup>2</sup> = 4.4197

OR = -16

R<sup>2</sup> = 4.4181

R = 980.75

In radiation: -0.75

R = 980.0<sup>v</sup>R = 2.1008<sup>v</sup>(1+a)R = 2.1002<sup>v</sup>R<sup>2</sup> = 4.4108<sup>v</sup>

a = -2.5



M41453 Times site

1913 June 24

15

Exp. to stars 1911 Dec 2<sup>nd</sup> 38<sup>m</sup> - 2<sup>nd</sup> 50<sup>m</sup>  
 Moon 2 44 10.0<sup>m</sup> - 2 44 10.2<sup>m</sup>  
 Clock show 0 49.8<sup>m</sup>

H Sid T 2 44 59.9<sup>m</sup>  
 H long 4 44 310.5<sup>m</sup>  
 G Sid T 7 29 30.95<sup>m</sup>  
 Sid T in Moon 16 40 50.77<sup>m</sup>  
 Interval 14 48 40.18<sup>m</sup>  
 Reduction 2 25.59<sup>m</sup>  
 G to T 14 46 14.59<sup>m</sup>

From Gun Ept  
 Tabular Place

R.A.

Decl.

Moon 14<sup>m</sup>1<sup>h</sup> 45<sup>m</sup> 49.08 41° 44' 51.2Moon 1<sup>h</sup> 47<sup>m</sup> 28.39

15 43.6

46.2432

1 39.31 41° 11' 53.8

Tabular Place

1 47 28.39 41° 56' 45.0

Moon's Parallax

59' 02.5"

Moon's Semidiameter

16' 06.85" = 966.85"

augmentation = 139

100 - 130

967 = 139

Computed Radius = 980.7

= 2.1023

 $R^2 = 441.97$  $0.2 = -1.6$  $R^2 = 441.81$  $R = 980.75$ 

In radiation: -0.75

 $R = 980.0$  $R = 2.1008$  $(1+a)R = 2100.2$  $R = 941.08$  $a = -2.5$

| ket. | psi. L | residual |
|------|--------|----------|
| 1    | 182.0  | +29      |
| 2    | 200.5  | -30      |
| 3    | 221.2  | +39      |
| 4    | 235.5  | +25      |
| 5    | 253.9  | -122     |
| 6    | 270.0  | -26      |
| 7    | 281.5  | -24      |
| 8    | 312.3  | -36      |
| 9    | 339.5  | +86      |

MC 1453

Moon's Center

1913 July 1.

16

|    | $x_c$   | $x - x_0$ | $(x - x_0)^2$ | $R^2$  | $0 - c$ |
|----|---------|-----------|---------------|--------|---------|
| 1  | 17.7364 | 0.0000    | 0.0000        | 4.4201 | + 9.3   |
| 2  | 17.0000 | -0.7364   | 0.5423        | 4.4177 | + 6.9   |
| 3  | 16.3495 | -1.3869   | 1.9235        | 4.4268 | + 1.60  |
| 4  | 16.0000 | -1.7364   | 3.0116        | 4.4260 | + 1.52  |
| 5  | 15.7184 | -2.0180   | 4.0723        | 4.4110 | + 2     |
| -6 | 15.6342 | -2.1022   | 4.4192        | 4.4192 | + 8.4   |
| 7  | 15.6765 | -2.0599   | 4.2432        | 4.4179 | + 7.1   |
| 8  | 16.1872 | -1.5492   | 2.4000        | 4.4110 | + 2     |
| 9  | 17.0000 | -0.7364   | 0.5423        | 4.4173 | + 6.5   |

Comp.  $R^2 = 4.4108$ 

|    | $y$     | $y - y_0$ | $\Delta y$ | $(y - y_0)^2$ |
|----|---------|-----------|------------|---------------|
| -1 | 20.4798 | -2.1022   | -2         | 4.4201        |
| 2  | 20.6136 | -1.9684   | -2         | 3.8754        |
| 3  | 21.0000 | -1.5820   | -2         | 2.5033        |
| 4  | 21.3928 | -1.1892   | -1         | 1.4144        |
| 5  | 22.0000 | -0.5820   | 0          | 0.3387        |
| 6  | 22.5820 | 0.0000    | 0          | 0.0000        |
| 7  | 23.0000 | +0.4180   | 0          | 0.1747        |
| 8  | 24.0000 | +1.4180   | +1         | 2.0110        |
| 9  | 24.5503 | +1.9683   | +2         | 3.8750        |

Approx. center

$x = 17.0$

$y = 20.6136$

$x = 16.0$

$y = 21.3928$

$24.5503$

$23.7645$

$451.639$

$45.1573$

mean  $y = 22.5820$

$22.5786$

$y - \text{min} = 20.4798$

$R = 2.1022$

$y = \text{min} = 15.6342$

$x_0 = 17.7364$

Assumed  
center  $\left\{ \begin{array}{l} x_0 = 17.7364 \\ y_0 = 22.5820 \end{array} \right.$



MC 1453

Linear Center

1913 July 1

16

|   | $x$      | $x - x_0$ | $(x - x_0)^2$ | $R^2$  | $O - C$ |
|---|----------|-----------|---------------|--------|---------|
| 1 | 17 73 64 | 0 0 0 0   | 0 0 0 0       | 4.4201 | + 9.3   |
| 2 | 17 00 00 | - 0 73 64 | 0 5423        | 4.4177 | + 6.9   |
| 3 | 16 34 95 | - 1 38 69 | 1 9235        | 4.4268 | + 1.60  |
| 4 | 16 00 00 | - 1 73 64 | 3.0116        | 4.4260 | + 1.52  |
| 5 | 15 71 84 | - 2 01 80 | 4 0723        | 4.4110 | + 2     |
| 6 | 15 63 42 | - 2 10 22 | 4 4192        | 4.4192 | + 8.9   |
| 7 | 15 67 65 | - 2 05 99 | 4 2432        | 4.4179 | + 7.1   |
| 8 | 16 18 72 | - 1 54 92 | 2 4000        | 4.4110 | + 2     |
| 9 | 17 00 00 | - 0 73 64 | 0 5423        | 4.4173 | + 6.5   |

Compute  $R^2 = 4.410 \checkmark$ 

|    | $y$      | $y - y_0$ | $\Delta y$ | $(y - y_0)^2$ |
|----|----------|-----------|------------|---------------|
| -1 | 20 47 98 | - 2 10 22 | - 2        | 4.4201        |
| 2  | 20 61 36 | - 1 46 84 | - 2        | 3.8759        |
| 3  | 21 00 00 | - 1 58 20 | - 2        | 2.5033        |
| 4  | 21 39 28 | - 1 18 92 | - 1        | 1.4144        |
| 5  | 22 00 00 | - 0 58 20 | 0          | 0.3387        |
| 6  | 22 58 20 | 0 00 00   | 0          | 0.0000        |
| 7  | 23 00 00 | + 0 41 80 | 0          | 0.1747        |
| 8  | 24 00 00 | + 1 41 80 | + 1        | 2.0110        |
| 9  | 24 55 03 | + 1 96 83 | + 2        | 3.8750        |

Approx. center

 $x = 170$  $y = 20.6136$  $x = 160$  $y = 21.3928$ 24 55 0323 76 45

45 1639

45 1573

mean  $y = 22.5820$ 

22 57 86

 $y - \text{min} = 20.4798$  $R = 2.1022$  $y - \text{max} = 15.6342$  $x_0 = 17 73 64$ 

Assumed  
center  $\left\{ \begin{array}{l} x = 17 73 64 \\ y = 22 58 20 \end{array} \right.$



MC 1453

Moon's Center

1913 Sept. 30.

17

## Conditional Equations

|   | a     | b     | 0    | C                | 0 - C |
|---|-------|-------|------|------------------|-------|
| 1 | 0.00  | -2.10 | +93  | 0 + 76 = +76     | +17   |
| 2 | -0.74 | -1.97 | +69  | +41 + 71 = +112  | -43   |
| 3 | -1.39 | -1.58 | +160 | +77 + 57 = +134  | +26   |
| 4 | -1.74 | -1.19 | +152 | +97 + 43 = +140  | +12   |
| 5 | -2.02 | -0.58 | +2   | +113 + 21 = +134 | -132  |
| 6 | -2.10 | +0.00 | +84  | +117 - 0 = +117  | -33   |
| 7 | -2.06 | +0.42 | +71  | +115 - 15 = +100 | -29   |
| 8 | -1.55 | +1.42 | +2   | +86 - 51 = +35   | -33   |
| 9 | -0.74 | +1.97 | +65  | +41 - 71 = -30   | +95   |

## Mean Equations

5) -4.88 - 7.13 = +475

4) -6.45 + 3.81 = +222

~~+6.45 + 11.85 = -790~~

~~+15.66 = -568~~

~~-3.88 + 475 - 259 = +216~~

+6.45 + 9.46 = -627

+13.21 = -405

-4.88 = +475 - 259 = +216

~~b = -36.3~~

~~a = -55.7~~

b = -30.6

a = -52.5

## Residuals

|   | a    | b | 0 | C                | 0 - C |
|---|------|---|---|------------------|-------|
| 1 | +93  |   |   | 0 + 64 = +64     | +29   |
| 2 | +69  |   |   | +39 + 60 = +99   | -30   |
| 3 | +160 |   |   | +73 + 48 = +121  | +39   |
| 4 | +152 |   |   | +91 + 36 = +127  | +25   |
| 5 | +2   |   |   | +106 + 18 = +124 | -122  |
| 6 | +84  |   |   | +110 - 0 = +110  | -26   |
| 7 | +71  |   |   | +108 - 13 = +95  | -24   |
| 8 | +2   |   |   | +81 - 43 = +38   | -36   |
| 9 | +65  |   |   | +39 - 60 = -21   | +86   |

Average = 46



MC 1453 Brown's Center

1913 Sept 30

11

## Conditional Equations

|   | a    | b    | 0 |      | c                | 0-c  |
|---|------|------|---|------|------------------|------|
| 1 | 000  | -210 | = | +93  | 0 + 76 = +76     | +17  |
| 2 | -074 | -197 | = | +69  | +41 + 71 = +112  | -43  |
| 3 | -139 | -158 | = | +160 | +77 + 57 = +134  | +26  |
| 4 | -174 | -119 | = | +152 | +97 + 43 = +140  | +12  |
| 5 | -202 | -058 | = | +2   | +113 + 21 = +134 | -132 |
| 6 | -210 | +000 | = | +84  | +117 - 0 = +117  | +33  |
| 7 | -206 | +042 | = | +71  | +115 - 15 = +100 | -29  |
| 8 | -155 | +142 | = | +2   | +86 - 51 = +35   | -33  |
| 9 | -074 | +197 | = | +65  | +41 - 71 = -30   | +95  |

## Mean Equations

5) -488 - 713 = +475

6) -645 + 381 = +222

+845 + 185 = -790

+1566 = -568

-388 + 475 - 259 = +216

+645 + 946 = -627

+1321 = -405

-488 = +475 - 219 = +256

b = -363

a = -552

b = -306

a = -525

## Residuals

|   | 0    |              | c    | 0-c  |
|---|------|--------------|------|------|
| 1 | +93  | + 0 + 64 =   | +64  | +29  |
| 2 | +69  | + 39 + 60 =  | +99  | -30  |
| 3 | +160 | + 73 + 48 =  | +121 | +39  |
| 4 | +152 | + 91 + 36 =  | +127 | +25  |
| 5 | +2   | + 106 + 18 = | +124 | -122 |
| 6 | +84  | + 110 - 0 =  | +110 | -26  |
| 7 | +71  | + 108 - 13 = | +95  | -24  |
| 8 | +2   | + 81 - 43 =  | +38  | -36  |
| 9 | +65  | + 39 - 60 =  | -21  | +86  |

Average = 46



1453 Moon's mean Position (1911.0)

$$\begin{array}{rcl}
 X_0 = 17.7364 & Y_0 = 22.5820 & \\
 \frac{1}{2}a = -26 & \frac{1}{2}b = -15 & \\
 \hline
 17.7338 & 22.5805 & 
 \end{array}$$

From Plate Constants,  $X = 18.5678$   $Y = 22.8016$ 

$$\begin{array}{l}
 \bar{x} = +0.5678 \\
 \log 3 = 9.75420 \\
 \text{wss} = 9.99278 \\
 \text{const} = 8.50724
 \end{array}$$

$$-(K-H) = 1.25478$$

$$A - A + 17.95$$

$$A = 1 \ 46 \ 23$$

$$\delta_0 = 1 \ 46 \ 40.95$$

$$\text{Red} = +3.29$$

$$\delta = 1 \ 46 \ 44.19$$

$$m = +0.8016$$

$$\log \tan 5 = 9.2700$$

$$" \ 32 = 9.5076$$

$$" \ m_1 = 5.8310$$

$$m_1 = +1$$

$$m_0 = +0.8015$$

$$\log m_0 = 9.90390$$

$$\text{const} = 7.33115$$

$$-(\delta - D) = 257275$$

$$\delta - D = +6 \ 13.9$$

$$D = +10 \ 18 \ 54$$

$$S_0 = +10 \ 25 \ 07.9$$

$$\text{Red} = +22.0$$

$$\delta = +10 \ 25 \ 29.9$$



1453 Moon's mean Position (1911.0)

18

$$X = 17\ 736\ 4$$

$$Y_0 = 22\ 5820$$

$$\text{corr} = -26$$

$$\text{corr} = -15$$

$$17\ 7338$$

$$22\ 5805$$

From Plate Constants  $X = 18\ 5673$   $Y = 22\ 8016$ 

$$\xi = +0\ 5678$$

$$\eta = +0\ 8016$$

$$\log \xi = 9\ 75424$$

$$\log \eta = 9\ 2700$$

$$\text{corr} = 9\ 99278$$

$$\text{corr} = 9\ 5076$$

$$\text{corr} = 8\ 50724$$

$$\text{corr} = 5\ 8310$$

$$(x - A) = 12\ 5378$$

$$\eta_1 = +1$$

$$A - A + 17\ 95$$

$$m_0 = +0\ 8015$$

$$A = 1\ 46\ 23$$

$$\log m_0 = 9\ 90390$$

$$d_0 = 1\ 46\ 40\ 95$$

$$\text{corr} = 7\ 33115$$

$$\text{Red} = +3\ 24$$

$$(d - D) = 2\ 57275$$

$$d - D = +6\ 139$$

$$d = 1\ 46\ 44\ 19$$

$$D = +10\ 18\ 54$$

$$S_0 = +10\ 25\ 079$$

$$\text{Red} = +2\ 20$$

$$d = +10\ 25\ 299$$



1453 Red ad locum app.

$$\delta = +10^{\circ} 25'$$

$$H + \alpha \quad 3^{\circ} 01' = 45^{\circ} 15'$$

$$H \quad 1 \quad 14$$

$$\alpha \quad 1 \quad 47$$

$$G \quad 22 \quad 16$$

$$G + \alpha \quad 23 \quad 57 = 359^{\circ} 15'$$

$$l \cos S \quad .99928$$

$$i \quad .04476$$

$$(i) \quad .04404$$

$$l \cos(G + \alpha) \quad 0.00000$$

$$S \quad 1.2205$$

$$\sin \quad 8.1169m$$

$$\tan S \quad 9.2644$$

$$8.8239$$

$$l \sin S \quad 9.2572$$

$$\cos(H + \alpha) \quad 9.8476$$

$$h \quad 1.3064$$

$$\sin \quad 9.8514$$

$$\sec S \quad 0.0072$$

$$8.8239$$

$$S' \quad 12205$$

$$74257m$$

$$h' \quad 04112$$

$$h \quad 9.9891$$

$$h \quad +2.26$$

$$S \quad -0.00$$

$$h \quad +0.98$$

$$+324 \checkmark$$

$$S' \quad +16.62$$

$$S \quad +2.58$$

$$i \quad +2.76$$

$$+2196 \checkmark$$



1453 Lunar Parallax.

$$\begin{array}{rcl}
 \alpha - & 1 & 46 \quad 44' 19'' \\
 \theta - & 2 & 44 \quad 59' 9'' \\
 \theta - \alpha - & + & 58 \quad 15' 7'' \\
 & + & 14'' \quad 33' 56''
 \end{array}$$

$$\begin{array}{rcl}
 & + & 5 \quad 36'' \\
 & + & 14 \quad 28 \quad 20''
 \end{array}$$

$$\begin{array}{r}
 9.95727 \\
 0.00000 \\
 0.01400 \\
 \hline
 9.97127
 \end{array}$$

$$\begin{array}{rcl}
 \gamma & = & 43 \quad 06 \quad 22'' \\
 & & 10 \quad 25 \quad 30'' \\
 & & 32 \quad 40 \quad 52''
 \end{array}$$

$$\begin{array}{r}
 9.82640 \\
 8.23486 \\
 9.73236 \\
 0.16536 \\
 \hline
 7.95898
 \end{array}$$

$$S - S' = +31 \quad 16.8''$$

$$S = +10 \quad 56 \quad 46.7''$$

$$\text{Nautical } S = +10 \quad 56 \quad 45.0''$$

$$O - C \quad + 1.7''$$

$$S' = +10^\circ 25' 29.9''^{19}$$

$$H = 59' 02.5''$$

$$\begin{array}{r}
 9.86913 \\
 8.23486 \\
 9.40052 \\
 0.00797 \\
 \hline
 7.51248
 \end{array}$$

$$\begin{array}{rcl}
 \alpha - \alpha' & + & 11' \quad 11.28'' \\
 & = & +44.75''
 \end{array}$$

$$\alpha = 1 \quad 47 \quad 28.94''$$

$$\alpha = 1 \quad 47 \quad 28.39''$$

$$+ 0.55''$$



Lunar Parallax

$$\begin{array}{r}
 1453 \\
 \alpha - 1 \quad 46 \quad 44' 19'' \\
 \theta - 2 \quad 44 \quad 59' 9'' \\
 \theta - \alpha - + 58 \quad 157 \\
 + 14 \quad 33' 56''
 \end{array}$$

$$+ 5 \quad 36$$

$$+ 14 \quad 28 \quad 20$$

$$\begin{array}{r}
 595727 \\
 000000 \\
 001400 \\
 \hline
 997127
 \end{array}$$

$$\gamma = 43 \quad 06 \quad 22$$

$$10 \quad 25' 30''$$

$$32 \quad 40 \quad 52$$

$$\begin{array}{r}
 982640 \\
 823486 \\
 973236 \\
 016536 \\
 \hline
 795898
 \end{array}$$

$$\delta - \delta' = +31 \quad 168$$

$$\delta = +10 \quad 56 \quad 467$$

$$\text{Haupt-Abweichung } \delta = +10 \quad 56 \quad 450$$

$$\theta - \alpha = +17$$

$$\delta = +10^\circ 25' 29''$$

$$\Pi = 59' 02''$$

$$\begin{array}{r}
 986913 \\
 823486 \\
 990052 \\
 000797 \\
 \hline
 751248
 \end{array}$$

$$\alpha - \alpha' = +11' 11'' 28$$

$$+4475$$

$$\alpha = 1 \quad 47 \quad 2894$$

$$\alpha = 1 \quad 47 \quad 2839$$

$$+055$$



MC 1462 Stars Measures.

1913 June 25. 20

|      | a              | N            | a              | N            |
|------|----------------|--------------|----------------|--------------|
| ✓    | 18545          | 16944        | 18610          | 18001        |
| 9.1  | 1643030        | 906070       | 996070         | 1662520      |
| 31.2 | 30             | 60           | 6070           | 25           |
| mg   | 50             | 58           | 08             | 10           |
| 6.6  | <u>31.2110</u> | <u>.2108</u> | <u>9.1357</u>  | <u>.1379</u> |
| 2    |                |              |                |              |
| 10.5 | 17009          | 16473        | 17398          | 16108        |
| 10.4 | 1330060        | 10190        | 1224549        | 11260        |
| mg   | 01             | 8889         | 41             | 6060         |
| 8.5  | 20             | 79           | 10             | 10           |
|      | <u>10.3713</u> | <u>.3712</u> | <u>10.4841</u> | <u>.4849</u> |
| 3    |                |              |                |              |
| 23.8 | 16030          | 19060        | 15310          | 16041        |
| 11.6 | 981610         | 1527282      | 13247          | 809895       |
| mg   | 12             | 8082         | 4047           | 9095         |
| 7.0  | 40             | 72           | 12             | 51           |
|      | <u>11.6223</u> | <u>.6214</u> | <u>237935</u>  | <u>.7955</u> |
| 4    |                |              |                |              |
| 30.4 | 19090          | 17935        | 16580          | 19510        |
| 26.2 | 1735850        | 968585       | 10402          | 1570298      |
| mg   | 5050           | 8285         | 6009           | 0098         |
| 6.8  | 98             | 50           | 92             | 20           |
|      | <u>26.1738</u> | <u>.1737</u> | <u>30.3817</u> | <u>.3814</u> |

Grade 3

E. J. ...

MIC 1462

Star measures

1913 June 25

20

|      | a             | N           | a             | N                   |
|------|---------------|-------------|---------------|---------------------|
| ✓    | 18545         | 16744       | 18610         | 18001               |
| 9.1  | 16430         | 906070      | 996070        | 16625 <sup>20</sup> |
| 312  | 30            | 60          | 6070          | 25 <sup>20</sup>    |
| mg   | 50            | 58          | 08            | 10                  |
| 66   | <u>312110</u> | <u>2105</u> | <u>91357</u>  | <u>1379</u>         |
| 2    |               |             |               |                     |
| 10.5 | 17009         | 16473       | 17398         | 16105               |
| 109  | 13300         | 10190       | 1224549       | 11260               |
| mg   | 01            | 88          | 41            | 60                  |
| 25   | 20            | 79          | 10            | 10                  |
|      | <u>103713</u> | <u>3712</u> | <u>104841</u> | <u>4849</u>         |
| 3    |               |             |               |                     |
| 238  | 16030         | 19060       | 15310         | 16041               |
| 11.6 | 9816          | 15272       | 1324747       | 8098                |
| mg   | 12            | 8082        | 4047          | 90                  |
| 7.0  | 40            | 72          | 12            | 51                  |
|      | <u>116223</u> | <u>6214</u> | <u>237935</u> | <u>7955</u>         |
| 4    |               |             |               |                     |
| 304  | 19090         | 17935       | 16580         | 19510               |
| 262  | 17358         | 9685        | 10402         | 15702               |
| mg   | 50            | 82          | 6009          | 0048                |
| 68   | 98            | 50          | 92            | 20                  |
|      | <u>261738</u> | <u>1737</u> | <u>303817</u> | <u>3814</u>         |

Grade 3



MC1452

Moon. measures.

1913 June 25 21

|      | $\alpha$       | $\delta$ | $\alpha$     | $\delta$ | $\alpha$       | $\delta$    |
|------|----------------|----------|--------------|----------|----------------|-------------|
| 1/   | 17110          |          | 15956        |          | 16330          |             |
| 16.7 | 1344040        |          | 962520       |          | 13385          | 85-         |
| 19.7 | 35             |          | 30           |          | 80             |             |
|      | 20             |          | 72           |          | 42             |             |
|      | <u>19.3676</u> |          | <u>.3659</u> |          | <u>16.7050</u> |             |
|      |                |          |              |          |                | <u>7057</u> |

|      |                |  |              |  |
|------|----------------|--|--------------|--|
| 2/   | 16092          |  | 14930        |  |
| 16.0 | 983530         |  | 1120000      |  |
| 19.6 | 30             |  | 09           |  |
|      | 00             |  | 45           |  |
|      | <u>19.6265</u> |  | <u>.6267</u> |  |

|      |  |  |                |  |              |
|------|--|--|----------------|--|--------------|
| 3/   |  |  | 15790          |  | 15450        |
| 15.5 |  |  | 1105148        |  | 1070010      |
| 20.0 |  |  | 49             |  | 94           |
|      |  |  | 02             |  | 60           |
|      |  |  | <u>15.5233</u> |  | <u>.5254</u> |

|      |  |  |         |  |        |
|------|--|--|---------|--|--------|
| 4/   |  |  | 10870   |  | 996965 |
| 14.9 |  |  | 1074331 |  | 50     |
| 21.0 |  |  | 41      |  | 9835   |

|                |              |
|----------------|--------------|
| <u>14.9868</u> | <u>.9874</u> |
|----------------|--------------|

|        |         |
|--------|---------|
| 9831   | 1061099 |
| 908382 | 0599    |
| 75     | 9870    |

|                |              |
|----------------|--------------|
| <u>14.9249</u> | <u>.9265</u> |
|----------------|--------------|

|         |        |
|---------|--------|
| -9802   | 905039 |
| 9.65030 | 49     |
| 31      | 8876   |

|                |              |
|----------------|--------------|
| <u>14.9835</u> | <u>.9830</u> |
|----------------|--------------|



KIC 1452

Lunar measurements

1913 June 21

| $\alpha$              | $\delta$    | $\alpha$      | $\delta$    | $\alpha$ | $\delta$ | $\alpha$ | $\delta$ |
|-----------------------|-------------|---------------|-------------|----------|----------|----------|----------|
| $\frac{1}{167}$ 17110 | 15956       | 16330         | 18018       |          |          |          |          |
| 199 1344040           | 962520      | 1338585       | 1096575     |          |          |          |          |
| 35                    | 30          | 80            | 68          |          |          |          |          |
| 20                    | 72          | 42            | 30          |          |          |          |          |
| <u>193676</u>         | <u>3659</u> | <u>167050</u> | <u>7057</u> |          |          |          |          |
| $\frac{2}{160}$ 16092 | 14930       |               |             |          |          |          |          |
| 196 983530            | 1120000     |               |             |          |          |          |          |
| 30                    | 09          |               |             |          |          |          |          |
| 00                    | 45          |               |             |          |          |          |          |
| <u>196265</u>         | <u>6247</u> |               |             |          |          |          |          |
| $\frac{3}{155}$       |             | 15790         | 15450       |          |          |          |          |
| 200                   |             | 1105148       | 1020010     |          |          |          |          |
|                       |             | 49            | 94          |          |          |          |          |
|                       |             | 02            | 60          |          |          |          |          |
|                       |             | <u>155253</u> | <u>5254</u> |          |          |          |          |
| $\frac{4}{149}$       |             | 10870         | 996965      |          |          |          |          |
| 210                   |             | 1074331       | 50          |          |          |          |          |
|                       |             | 41            | 9835        |          |          |          |          |
|                       |             | <u>149868</u> | <u>9874</u> |          |          |          |          |
| $\frac{5}{149}$       |             | 9831          | 1061099     |          |          |          |          |
| 215                   |             | 908382        | 0599        |          |          |          |          |
|                       |             | 7582          | 9870        |          |          |          |          |
|                       |             | <u>149249</u> | <u>9265</u> |          |          |          |          |
| $\frac{6}{149}$       |             | 9802          | 905039      |          |          |          |          |
| 220                   |             | 965030        | 4939        |          |          |          |          |
|                       |             | 31            | 8876        |          |          |          |          |
|                       |             | <u>149835</u> | <u>9830</u> |          |          |          |          |



MC 1463  $\alpha$   $\mu$  Orion - Measures  $\alpha$   $\mu$  1913 June 20 22  
 $\alpha$   $\mu$   $\alpha$   $\mu$   
 $\frac{7}{15.5}$   $\frac{14871}{1030592}$   $\frac{18906}{1347589}$   
 23.0 95 87  
 77 06  
15.5423 5422

$\frac{8}{16.0}$  19040 17111  
 234 1540094 1075259  
 09 55  
 60 26  
23.3646 .3634  
 $\frac{9}{17.0}$  18001 16145  
 236 1148068 1268903  
 not 81 00  
 in 11 55  
 $\frac{8}{23.6532}$  .6549



MC 1462

Lubin Measures

1913 June 25

22

$$\begin{array}{r} 2 \\ 155 \\ \hline 230 \end{array}$$

$$\begin{array}{r} 14871 \\ 10305 \\ \hline 95 \\ 77 \\ \hline 155423 \end{array}$$

$$\begin{array}{r} 18906 \\ 13475 \\ \hline 87 \\ 06 \\ \hline 5422 \end{array}$$

$$\begin{array}{r} 8 \\ 160 \\ 234 \\ \hline 19040 \\ 1540094 \\ 09 \\ 60 \\ \hline 233646 \end{array}$$

$$\begin{array}{r} 17111 \\ 10752 \\ \hline 55 \\ 26 \\ \hline 3634 \end{array}$$

$$\begin{array}{r} 9 \\ 170 \\ 236 \\ \hline 18001 \\ 1198068 \\ 81 \\ 11 \\ \hline 236532 \end{array}$$

$$\begin{array}{r} 16145 \\ 1268903 \\ 00 \\ 55 \\ \hline 6549 \end{array}$$

Star 2

AG. Belin B. 1211 Epoch 1881.5 2.060  
 8.6 1880.2 2.060

|                                |        |      |    |       |             |
|--------------------------------|--------|------|----|-------|-------------|
| 3 <sup>h</sup> 42 <sup>m</sup> | 29.83  | + 20 | 46 | 30.6  |             |
| 1                              | 27.32  | +    | 4  | 41.8  | Peru to low |
| 3. 43                          | 59.15  | 20   | 51 | 17.4  |             |
| 3 43                           | 57.17  | 20   | 51 | 17.2  | cape an     |
|                                | + 0.02 |      |    | + 0.2 |             |

Star 3

AG

|      |       |      |    |       |      |
|------|-------|------|----|-------|------|
| 3 49 | 52.23 | + 20 | 57 | 32.0  |      |
| 1    | 27.55 |      | 4  | 28.3  | Peru |
| 3 51 | 19.78 | + 21 | 2  | 0.3   |      |
| 3 51 | 19.86 | + 21 | 2  | 0.1   |      |
|      | + .08 |      |    | - 0.2 |      |

| MC 1462             |      |     |         | Standard Coordinates    |     |         |      | 1913 June 26. |  |  |  |
|---------------------|------|-----|---------|-------------------------|-----|---------|------|---------------|--|--|--|
| Cape No. 550 mg. 66 |      |     |         | Cape No. 555 mg. 8.5-23 |     |         |      |               |  |  |  |
| C                   | 3    | 43  | 00.35   | 3                       | 43  | 57.15   | 0    | 207           |  |  |  |
| L                   |      |     |         |                         |     |         |      | 165           |  |  |  |
| E                   |      |     |         |                         |     |         |      |               |  |  |  |
| mean                |      |     |         |                         |     |         |      |               |  |  |  |
| Prec                |      |     | +39.11  |                         |     |         |      |               |  |  |  |
| A                   | 3    | 43  | 39.46   | 3                       | 44  | 35.62   |      |               |  |  |  |
| A                   | 3    | 48  | 44      | 3                       | 48  | 44      |      |               |  |  |  |
| K-A                 | -    | 5   | 04.54   | -                       | 4   | 08.38   |      |               |  |  |  |
| sin(K-A)            |      |     | -304.52 |                         |     | -248.37 |      |               |  |  |  |
| log                 | 2    | 48  | 36.2    | 2                       | 39  | 51.0    |      |               |  |  |  |
| -cos                | 9    | 96  | 21.1    | 9                       | 97  | 04.7    |      |               |  |  |  |
| -S <sub>0</sub>     | 0    | 95  | 29.7    | 0                       | 87  | 28.1    |      |               |  |  |  |
| S <sub>0</sub>      | -    | 8   | 97.36   | -                       | 7   | 46.12   |      |               |  |  |  |
| S <sub>1</sub>      | -    |     | 36      | -                       |     | 35      |      |               |  |  |  |
| S <sub>2</sub>      | 9    | 02  | 28      | 10                      | 53  | 53      |      |               |  |  |  |
| 2                   | 9    | 13  | 68      | 10                      | 48  | 45      |      |               |  |  |  |
| 2-3                 |      |     | +1140   |                         |     | -508    |      |               |  |  |  |
| C                   | +23° | 33' | 04"6    | +20°                    | 51' | 17.25   |      |               |  |  |  |
| L                   |      |     |         |                         |     | 17.21   |      |               |  |  |  |
| E                   |      |     |         |                         |     | 17.21   |      |               |  |  |  |
| Mean                |      |     |         |                         |     |         |      |               |  |  |  |
| Prec                |      |     | +203.2  |                         |     | +2-03.1 |      |               |  |  |  |
| S                   | +23  | 35  | 07.8    | +20                     | 53  | 20.3    |      |               |  |  |  |
| D                   | +22  | 23  | 42      | +22                     | 23  | 42      |      |               |  |  |  |
| S-D                 | +1   | 11  | 25.8    | -                       | 1   | 30      | 21.7 |               |  |  |  |
| tan(S-D)            |      |     | +4286.4 |                         |     | -5423.0 |      |               |  |  |  |
| log                 | 3    | 63  | 20.9    | 3                       | 73  | 42.4    |      |               |  |  |  |
| -m <sub>0</sub>     | 0    | 96  | 32.4    | 1                       | 06  | 53.9    |      |               |  |  |  |
| tanS                | 9    | 64  | 01      | 9                       | 58  | 17      |      |               |  |  |  |
| S <sup>2</sup>      | 1    | 90  | 59      | 1                       | 74  | 56      |      |               |  |  |  |
| m <sub>1</sub>      | 8    | 59  | 94      | 8                       | 38  | 07      |      |               |  |  |  |
| m <sub>0</sub>      | +9   | 18  | 84      | -                       | 11  | 62      | 46   |               |  |  |  |
| m <sub>1</sub>      | +3   | 98  |         | +2                      | 40  |         |      |               |  |  |  |
| m <sub>2</sub>      | 31   | 22  | 82      | 10                      | 39  | 94      |      |               |  |  |  |
| 4                   | 31   | 21  | 09      | 10                      | 37  | 12      |      |               |  |  |  |
|                     | -1   | 73  |         | -2                      | 82  |         |      |               |  |  |  |



| 1913 June 26          |      |    |      | 1913 June 26                |      |    |       |
|-----------------------|------|----|------|-----------------------------|------|----|-------|
| Cape Th. 550 m. g. 66 |      |    |      | Cape Th. 550 m. g. 8.5 - 23 |      |    |       |
| C                     | 3    | 43 | 00   | 35                          | 3    | 43 | 57    |
| L                     |      |    |      |                             |      |    | 15    |
| E                     |      |    |      |                             |      |    | 20    |
| Mean                  |      |    |      |                             |      |    | 165   |
| Pres                  |      |    | + 39 | 11                          |      |    | + 38  |
| A                     | 3    | 43 | 39   | 46                          | 3    | 44 | 35    |
| A                     | 3    | 48 | 44   |                             | 3    | 48 | 44    |
| X-A                   | -    | 5  | 04   | 54                          | -    | 4  | 08    |
| Sum(X-A)              |      |    | - 3  | 04                          | 52   |    | - 2   |
| log                   | 2    | 48 | 36   | 2                           | 2    | 39 | 51    |
| cos                   | 9    | 96 | 21   |                             | 9    | 97 | 04    |
| S <sub>0</sub>        | 0    | 95 | 29   | 7                           | 0    | 87 | 28    |
| S <sub>1</sub>        | -    | 8  | 97   | 36                          | -    | 7  | 46    |
| S <sub>2</sub>        | -    |    | 36   |                             | -    |    | 35    |
| S <sub>3</sub>        | 9    | 02 | 28   |                             | 10   | 53 | 53    |
| S <sub>4</sub>        | 9    | 13 | 68   |                             | 10   | 48 | 45    |
| 2-3                   |      |    | + 1  | 140                         |      |    | - 508 |
| C                     | + 23 | 33 | 04   | 6                           | + 20 | 51 | 17    |
| L                     |      |    |      |                             |      |    | 25    |
| E                     |      |    |      |                             |      |    | 17    |
| Mean                  |      |    |      |                             |      |    | 21    |
| Pres                  |      |    | + 2  | 03                          | 2    |    | + 20  |
| S                     | + 23 | 35 | 07   | 8                           | + 20 | 53 | 20    |
| D                     | + 22 | 23 | 42   |                             | + 22 | 23 | 42    |
| S-D                   | + 1  | 11 | 25   | 8                           | -    | 1  | 30    |
| Tan(S-D)              |      |    | + 4  | 28                          | 64   |    | - 54  |
| log                   | 3    | 63 | 20   | 9                           | 3    | 73 | 42    |
| - m <sub>1</sub>      | 0    | 96 | 32   | 4                           | 1    | 06 | 53    |
| Tan S                 | 9    | 64 | 01   |                             | 9    | 58 | 17    |
| S <sub>1</sub>        | 1    | 90 | 59   |                             | 1    | 74 | 56    |
| m <sub>1</sub>        | 8    | 59 | 94   |                             | 8    | 38 | 07    |
| m <sub>2</sub>        | + 9  | 12 | 84   |                             | -    | 1  | 62    |
| m <sub>3</sub>        | + 3  | 98 |      |                             | + 2  | 40 |       |
| m <sub>4</sub>        | 3    | 12 | 28   | 2                           | 1    | 03 | 99    |
| q                     | 3    | 12 | 10   | 9                           | 1    | 03 | 71    |
|                       | -    | 1  | 73   |                             | -    | 2  | 82    |



MC 1462

Standard course

1913 June 26

24.

Cape no. 574 mag 7.0  
 3<sup>h</sup> 51<sup>m</sup> 19.83<sup>s</sup>  
 L .88  
 E .86  
 mean 3 51 19.86<sup>v</sup>  
 Prec + 38.59<sup>v</sup>  
 $\alpha$  3 51 58.45<sup>v</sup>  
 A 3 48 44<sup>v</sup>  
 $\alpha - A$  + 3 14.45<sup>v</sup>  
 $\sin(\alpha - A)$  + 194.44<sup>v</sup>  
 $\log''$  2.28879<sup>v</sup>  
 $\log'' \cos$  9.96996<sup>v</sup>  
 $\log'' 3_0$  0.76599<sup>v</sup>  
 $\log''$  + 58343<sup>v</sup>  
 $\log''$  + 20<sup>v</sup>  
 $\log''$  23.8363<sup>v</sup>  
 $\log''$  23.7945<sup>v</sup>  
 $\log'' - 3$  - 418<sup>v</sup>

C + 21° 02' 00.05<sup>v</sup>  
 L 00.58  
 E 59.56  
 mean + 21 02 00.1  
 Prec + 1 57.1<sup>v</sup>  
 S + 21 03 57.2<sup>v</sup>  
 D + 22 23 42<sup>v</sup>  
 S - D - 1 19 44.8<sup>v</sup>  
 $\tan(\alpha - A)$  - 4785.6<sup>v</sup>  
 $\log''$  3.67993<sup>v</sup>  
 $\log'' m_0$  1.01108<sup>v</sup>  
 $\log'' \tan \delta$  9.5857<sup>v</sup>  
 $\log'' - 32$  1.5320<sup>v</sup>  
 $\log'' - 21$  8.1711<sup>v</sup>  
 $m_1$  - 10.2584<sup>v</sup>  
 $m_0$  + 148<sup>v</sup>  
 $m$  11.7564<sup>v</sup>  
 $q$  11.6218<sup>v</sup>  
 $q - m$  - 1346<sup>v</sup>

Cape no. 579 mag 6.8  
 3<sup>h</sup> 55<sup>m</sup> 00.36<sup>s</sup>  
 L .36  
 E .35  
 mean 3 55 00.36<sup>v</sup>  
 Prec + 39.11<sup>v</sup>  
 $\alpha$  3 55 39.47<sup>v</sup>  
 A 3 48 44<sup>v</sup>  
 $\alpha - A$  + 6 55.47<sup>v</sup>  
 $\sin(\alpha - A)$  + 415.41<sup>v</sup>  
 $\log''$  2.61848<sup>v</sup>  
 $\log'' \cos$  9.96419<sup>v</sup>  
 $\log'' 3_0$  1.08991<sup>v</sup>  
 $\log''$  + 12.3000<sup>v</sup>  
 $\log''$  + 50<sup>v</sup>  
 $\log''$  30.3050<sup>v</sup>  
 $\log''$  30.3816<sup>v</sup>  
 $\log'' - 3$  + 766<sup>v</sup>

+ 22° 55' 10.6<sup>v</sup>  
 L 11.3  
 E 10.6  
 mean + 22 55 10.8  
 Prec + 1 53.7<sup>v</sup>  
 S + 22 57 04.5<sup>v</sup>  
 D + 22 23 42<sup>v</sup>  
 S - D + 33 22.5<sup>v</sup>  
 $\tan(\alpha - A)$  + 2002.8<sup>v</sup>  
 $\log''$  3.30159<sup>v</sup>  
 $\log'' m_0$  0.63274<sup>v</sup>  
 $\log'' \tan \delta$  9.6268<sup>v</sup>  
 $\log'' - 32$  2.1798<sup>v</sup>  
 $\log'' - 21$  8.8600<sup>v</sup>  
 $m_1$  + 4.2938<sup>v</sup>  
 $m_0$  + 725<sup>v</sup>  
 $m$  26.3653<sup>v</sup>  
 $q$  26.1738<sup>v</sup>  
 $q - m$  - 1975<sup>v</sup>



14-1462

Standard

Covers

1913 June 26

24

Cape No. 574 mag 7.0

Cape No. 577 mag 6.8

C 3<sup>h</sup> 51<sup>m</sup> 19<sup>s</sup> 8.3  
 L 8.8  
 E 8.6  
 mean 3 51 19.86  
 Prec + 38.59  
 d 3 51 58.45  
 A 3 48 44  
 α-4 + 3 14.45  
 sub(A) + 194.44  
 mag 2.28879  
 cos δ 9.96996  
 S<sub>0</sub> 0.76599  
 S<sub>1</sub> + 58343  
 S<sub>2</sub> + 20  
 S<sub>3</sub> 23.8363  
 S<sub>4</sub> 23.7945  
 S<sub>5</sub> - 418

4  
 C 3<sup>h</sup> 55<sup>m</sup> 00<sup>s</sup> 3.6  
 L 3.6  
 E 3.5  
 mean 3 55 00.36  
 Prec + 39.11  
 d 3 55 39.47  
 A 3 48 44  
 α-4 + 6 55.47  
 sub(A) + 415.41  
 mag 2.61848  
 cos δ 9.96419  
 S<sub>0</sub> 1.08991  
 S<sub>1</sub> + 12.3000  
 S<sub>2</sub> + 50  
 S<sub>3</sub> 30.3050  
 S<sub>4</sub> 30.3816  
 S<sub>5</sub> + 766

C + 21° 02' 00.05  
 L 00.58  
 E 59.56  
 mean + 21 02 00.1  
 Prec + 1 57.1  
 S + 21 03 57.2  
 D + 22 23 42  
 S-D - 1 19 44.8  
 Tang (t-A) - 47.856  
 mag 3.67993  
 m<sub>0</sub> 10.1108  
 Tan S 9.5857  
 S<sub>2</sub> 1.5320  
 S<sub>1</sub> 8.1711  
 m<sub>1</sub> - 10.2584  
 m<sub>0</sub> + 1.48  
 m 11.7564  
 q 11.0218  
 q-m - 13.46

0  
 C + 22° 55' 10.6  
 L 11.3  
 E 10.6  
 mean + 22 55 10.8  
 Prec + 1 53.9  
 S + 22 57 04.7  
 D + 22 23 42  
 S-D + 33 22.7  
 Tang (t-A) + 20.028  
 mag 3.30164  
 m<sub>0</sub> 0.63279  
 Tan S 9.6268  
 S<sub>2</sub> 2.1798  
 S<sub>1</sub> 8.8600  
 m<sub>1</sub> + 4.2933  
 m<sub>0</sub> + 7.25  
 m 26.3658  
 q 26.1738  
 q-m - 1.920

M 1462

19135 July 16

Eph. to star 1911 Dec 4, 7<sup>m</sup> 0 1<sup>m</sup> 7<sup>m</sup> 13<sup>m</sup>  
 moon 7 0 7 2 2 9 7 0 7 2 3 1  
 clock slow 0 5 0 6

H.S. at 7 0 8 13 6  
 H. long 4 4 4 31 0 5  
 G. lat T 11 5 2 44 6 5  
 S. T. 2 moon 16 4 8 43 8 9  
 Interval 19 0 4 00 7 6  
 Reduction 3 0 7 4 2  
 G. lat T 19 0 0 53 3 4

from Nant Alm R. C. - peak  
 moon 19<sup>m</sup> 3 5 0 4 2 3 2 + 2 2 4 7 0 8 3  
 moon 1<sup>m</sup> 2 5 8 8 5 10 7 7 7  
 0.889 02.30 + 09.6  
 Tabular place 3 5 0 44 6 2 + 2 2 4 7 1 7 9

Moon parallel 60' 43.8  
 - - - - - 16' 34.3" = 994.3

434 - 11 0  
 494 - 12 5

Augmentation + 1 2 5  
 inclination trade 3 - 0 7  
 R 10 0 6 1

a = - .00005

R = 21567  
 (1+a)R = 21566  
 R<sup>2</sup> = 46509

MC 1462

19/3 June 26.

25

## Center of Plate

| $\alpha$         | $\gamma$    | $P.A.$                     | $\Delta\alpha$ |
|------------------|-------------|----------------------------|----------------|
| 9 1 3 6 8        | 3 1 2 1 0 9 | 3 <sup>h</sup> 4 3 3 9 +23 | 3 5 0 8        |
| 10 4 8 4 5       | 1 0 3 7 1 2 | 4 4 3 6 +20                | 5 3 2 0        |
| 2 3 7 9 4 5      | 1 1 6 2 1 8 | 5 1 5 8 +21                | 0 3 5 7        |
| 30 3 8 1 6       | 2 6 1 7 3 8 | 5 5 3 9 +22                | 5 7 0 5        |
| 4   7 3 8 0      | 7 9 3 8     | 1 9 5 5 2                  | 8 2 9 3 0      |
| 1 8 4 5          | 1 9 8 5     | 3 4 8 5 8 +22              | 0 7 2 2        |
| -1 8             | -2 2        | - 1 4                      | + 1 6 2 0      |
| 4 5              | 2 1 5       | 3 <sup>h</sup> 4 8 4 4     | +22 2 3 4 2    |
| 3 1              | 4 6 5       |                            |                |
| 1 4 <sup>s</sup> | 9 8 0       |                            |                |

$$A = 3^h 48^m 44^s$$

$$D = +22^\circ 23' 42''$$

$$\begin{aligned} \alpha - 3 &= -794 & +0.5\alpha &= +1322 \\ +1140 - 2466 &= -1326 & +5 &= -1321 & = +1 \\ -508 - 819 &= -1327 & +5 &= -1322 & = 0 \\ -418 - 918 &= -1336 & +12 &= -1324 & = -2 \\ +766 - 2068 &= -1302 & +15 &= -1287 & \text{reject} + 35 \\ 17.0830 - 1698 & & +9 & & = 17.0463 \end{aligned}$$

$$\begin{aligned} \gamma - \alpha &= +80x & -557 & \\ -174 + 731 &= +557 & = 0 & \\ -282 + 839 &= +557 & = 0 & \\ -1346 + 1904 &= +558 & = +1 & \\ -1915 + 2431 &= +516 & = -41 & \text{reject} \\ 21.4949 + 1367 & & = 21.5754 & \end{aligned}$$

$$\begin{aligned} \text{Tables } a &= -1.7 & e &= -1.3 & a - e &= -0.4 & b + a &= -2.9 \\ \text{Obs. } & -0.5 & & 0.0 & & -0.5 & & -1.0 \\ C - 0 & & & & & +0.1 & & -1.9 \end{aligned}$$

MC1462

1913 July 16

Times etc  
 Eph. to star 1911 Dec. 4, 7<sup>h</sup> 01<sup>m</sup> 13<sup>s</sup> ✓  
 " " moon 7 07 22.9 ✓ 7 07 23.1 ✓  
 clock slow 0 50.6 ✓

H. Sid. T. 7 08 13.6 ✓  
 H. long 4 44 31.05 ✓  
 G. Sid. T. 11 52 44.65 ✓  
 S. T. N. moon 16 48 43.89 ✓  
 Interval 19 04 00.76 ✓  
 Reduction 3 07.42 ✓  
 G. M. T. 19 00 53.34 ✓

from Kantalm. R. A. decl.  
 moon 19<sup>h</sup> 3<sup>m</sup> 50<sup>s</sup> 42.32 + 22° 47' 08.3 ✓  
 motion in 2.5 8.85 ✓ 10.777 ✓  
 " 0.889 ✓ 02.30 ✓ + 09.6 ✓  
 Tabular place 3 50 44.62 + 22 47 17.9 ✓

Moon's parallax 60' 43.8 ✓  
 - Secindium 16' 34.3" = 994."3 ✓

934 = 11.0  
 994 = 12.5

Augmentation + 12.5 ✓  
 Irradiation grade 3 - 0.7 ✓  
 R = 1006."1 ✓

$a = -.00005$  ✓  
 $R = 2.1567$  ✓  
 $(1+a)R = 2.1566$  ✓  
 $R^2 = 4.6509$  ✓

MC 1962

1913 June 26 25

## Center of Plate

| $x$         | $y$         | $PA$              | $Revol$      |
|-------------|-------------|-------------------|--------------|
| 9 1 3 6 8   | 3 1 2 1 0 9 | 3 <sup>h</sup> 43 | 39 +23 35 08 |
| 10 4 8 4 5  | 10 3 7 1 2  | 44                | 36 +20 53 20 |
| 23 7 9 4 5  | 1 1 6 2 1 8 | 51                | 58 +21 03 57 |
| 30 3 8 1 6  | 26 1 7 3 8  | 55                | 39 +22 57 05 |
| 4   7 3 8 0 | 7 9 3 8     | 195               | 52 8 29 30   |
| 18 +5       | 1985        | 3 48              | 58 +22 07 22 |
| -15         | 02          | -                 | 74 + 16 20   |
| 45          | 215         | 3 <sup>h</sup> 48 | 44 +22 23 42 |
| 31          | 461         |                   |              |
| 145         | 780         |                   |              |

$$A = 3^h 48^m 44^s$$

$$D = +22^\circ 23' 42''$$

$$\begin{aligned}
 x-3 & -794 & +0.5x & +1322 \\
 +1140 & -2466 & = -1326 & +5 = -1321 & = +1 \\
 -508 & -819 & = -1327 & +5 = -1322 & = 0 \\
 -418 & -918 & = -1336 & +12 = -1324 & = -2 \\
 +766 & -2068 & = -1302 & +15 = -1287 & \text{reject} \\
 170830 & -1698 & +9 & & = 170463
 \end{aligned}$$

$$\begin{aligned}
 y-m & +80x & -557 \\
 -174 & +731 & = +557 & = 0 \\
 -282 & +839 & = +557 & = 0 \\
 -1346 & +1904 & = +558 & = +1 \\
 -1915 & +2431 & = +516 & = -41 \text{ reject} \\
 214949 & +1367 & & = 215754
 \end{aligned}$$

$$\begin{aligned}
 \text{Tables } a & = -1.7 & b & = -13 & a+b & = -0.4 & b+a & = -2.9 \\
 \text{Obs } & -0.5 & & 00 & & -0.5 & & -1.0 \\
 C & = 0 & & & & +0.1 & & -1.9
 \end{aligned}$$

new source

ML1462

Moon's Center

26.

|   | $x$     | $x - X_0$ | $\Delta x$ | $(x - X_0)^2$ | $(x - X_0)^2 + (y - Y_0)^2$ | $O - C$ |
|---|---------|-----------|------------|---------------|-----------------------------|---------|
| 1 | 16.7059 | -0.3791   | -6         | 0.1442        | 4.6675                      | +166    |
| 2 | 16.0000 | -1.0845   | -5         | 1.1772        | 4.6689                      | +180    |
| 3 | 15.5254 | -1.5591   | -4         | 2.4320        | 4.6686                      | +167    |
| 4 | 14.9871 | -2.0974   | -1         | 4.3995        | 4.6448                      | -61     |
| 5 | 14.9257 | -2.1588   | 0          | 4.6604        | 4.6604                      | +95     |
| 6 | 14.9832 | -2.1013   | +1         | 4.4150        | 4.6697                      | +197    |
| 7 | 15.5422 | -1.5423   | +4         | 2.3775        | 4.6413                      | -96     |
| 8 | 16.0000 | -1.0845   | +5         | 1.1751        | 4.6668                      | +159    |
| 9 | 17.0000 | -0.0845   | +6         | 0.0071        | 4.6671                      | +162    |

Compu.  $R^2 = 4.6509$ 

|   | $y$     | $y - Y_0$ | $\Delta y$ |        |
|---|---------|-----------|------------|--------|
| 1 | 19.3684 | -2.1269   | -1         | 4.5233 |
| 2 | 19.6266 | -1.8687   | +1         | 3.4917 |
| 3 | 20.0000 | -1.4953   | +1         | 2.2356 |
| 4 | 21.0000 | -0.4953   | +0         | 0.2453 |
| 5 | 21.4953 | 0.0000    | 0          | 0.0000 |
| 6 | 22.0000 | +0.5047   | -0         | 0.2547 |
| 7 | 23.0000 | +1.5047   | -1         | 2.2638 |
| 8 | 23.3640 | +1.8687   | -1         | 3.4917 |
| 9 | 23.6541 | +2.1588   | +1         | 4.6600 |

Approx. Center

$$x = 16.0 \quad y = 19.6266$$

$$23.3640$$

$$42.9906$$

$$\text{mean } y = 21.4953$$

$$y = \text{max} = 23.6541$$

$$R = 2.1588$$

$$x = \text{min} = 14.9257$$

$$\text{mean } x = 17.0845$$

$$\text{Center} \begin{cases} X_0 = 17.0845 \\ Y_0 = 21.4953 \end{cases}$$



ML 1462

Approx. Center

26

|   | $x$    | $x - X_0$ | $\Delta x$ | $(x - X_0)^2$ | $(x - X_0)(y - Y_0)$ | $y - Y_0$ |
|---|--------|-----------|------------|---------------|----------------------|-----------|
| 1 | 167054 | -03791    | -6         | 0.1442        | 46675                | +166      |
| 2 | 160000 | -10845    | -5         | 1.1772        | 46689                | +180      |
| 3 | 155254 | -15591    | -4         | 2.4320        | 46676                | +167      |
| 4 | 149871 | -20974    | -1         | 4.3995        | 46448                | -61       |
| 5 | 149257 | -21588    | 0          | 4.6604        | 46604                | +95       |
| 6 | 149832 | -21013    | +1         | 4.4150        | 46697                | +197      |
| 7 | 155422 | -15423    | +4         | 2.3775        | 46413                | -96       |
| 8 | 160000 | -10845    | +5         | 1.1751        | 46668                | +159      |
| 9 | 170000 | 00845     | +6         | 0.0071        | 46671                | +162      |

Comp.  $R^2 = 4.6509$ 

|   | $y$    | $y - Y_0$ | $\Delta y$ |       |
|---|--------|-----------|------------|-------|
| 1 | 193684 | -21269    | +1         | 45233 |
| 2 | 196266 | -18687    | +1         | 34917 |
| 3 | 200000 | -14953    | +1         | 22356 |
| 4 | 210000 | 04953     | +0         | 02453 |
| 5 | 214953 | 00000     | 0          | 00000 |
| 6 | 220000 | +05047    | -0         | 02547 |
| 7 | 230000 | +15047    | -1         | 22638 |
| 8 | 233640 | +18687    | -1         | 34917 |
| 9 | 236541 | +21588    | -1         | 46600 |

Approx. Center

 $x = 160$   $y = 196266$ 233640

429906

mean  $y$  214953 $y$  max 236541 $R$  21588 $x$  min 149257mean  $x$  170845Center  $\left\{ \begin{array}{l} X_0 = 170845 \\ Y_0 = 214953 \end{array} \right.$

## Formation of Normals

|   | ab                 | an                  | bn                  |
|---|--------------------|---------------------|---------------------|
| 1 | +0.81 <sup>v</sup> | -63.1 <sup>v</sup>  | -353.6 <sup>v</sup> |
| 2 | +2.02 <sup>v</sup> | -194.4 <sup>v</sup> | -336.6 <sup>v</sup> |
| 3 | +2.34 <sup>v</sup> | -260.5 <sup>v</sup> | -250.5 <sup>v</sup> |
| 4 | +6.26 <sup>v</sup> | +32.0 <sup>v</sup>  | +7.5 <sup>v</sup>   |
| 5 | -0.00 <sup>v</sup> | +205.2 <sup>v</sup> | +0.0 <sup>v</sup>   |
| 6 | -1.05 <sup>v</sup> | -443.7 <sup>v</sup> | +98.5 <sup>v</sup>  |
| 7 | -0.58 <sup>v</sup> | +37.0 <sup>v</sup>  | -36.0 <sup>v</sup>  |
| 8 | -2.02 <sup>v</sup> | -171.7 <sup>v</sup> | +247.3 <sup>v</sup> |
| 9 | -0.17 <sup>v</sup> | -13.0 <sup>v</sup>  | +349.9 <sup>v</sup> |

$$[ab] = +1.61 \quad [an] = -1042.6 \quad [bn] = -223.5$$

## Normal Equations

$$+17.40 + 1.61 = -125.3$$

$$+1.61 + 19.91 = -224$$

$$-1.61 - 0.15 = +106$$

$$+19.76 = -118 \quad b = -6.0$$

$$-0.13 - 1.61 = +18$$

$$+17.27 = -1235 \quad a = -71.5$$

11C1862

1913 Sept 25

27

## Conditional Equations

|                  | a     | b     | 0      |                  | 0 - c |
|------------------|-------|-------|--------|------------------|-------|
| 1                | -0.38 | -2.13 | = +166 | + 27 + 13 = +40  | +126  |
| 2                | -1.08 | -1.87 | = +180 | + 77 + 11 = +88  | +92   |
| 3                | -1.56 | -1.50 | = +167 | + 112 + 9 = +121 | +46   |
| 4 <sup>int</sup> | -2.10 | -0.50 | = -61  | + 150 + 3 = +153 | -214  |
| 5                | +2.16 | +0.00 | = +95  | + 155 - 0 = +155 | -60   |
| 6                | -2.10 | +0.50 | = +197 | + 150 - 3 = +147 | +45   |
| 7 <sup>int</sup> | -1.54 | +1.50 | = -96  | + 116 - 9 = +107 | -197  |
| 8                | -1.08 | +1.87 | = +159 | + 77 - 11 = +66  | +93   |
| 9                | -0.08 | +2.16 | = +162 | + 86 - 13 = +73  | +169  |

## Mean Equations

$$1) -4.07a - 5.75b = +483$$

$$5) -6.19a + 5.28b = +565$$

$$+4.07 - 3.48 = -372$$

$$-9.23 = +111$$

$$b = -112.0$$

$$-6.19a = +565 + 64 = +629$$

$$a = -101.5$$

a b

$$5) -6.23 - 5.75b = +578$$

$$4) -4.03 + 5.28b = +470$$

$$+6.23 - 847 = -726$$

$$-13.92 = -148$$

$$b = +10.6$$

$$-4.03 = +470 - 56 = +414$$

$$a = -102.5$$



1101462

1913 Sept 25

27

## Conditional Equations

|   | a     | b     | 0       |                  | c - c |
|---|-------|-------|---------|------------------|-------|
| 1 | -0.38 | -2.13 | = +1.66 | + 27 + 13 = +40  | +1.26 |
| 2 | -1.08 | -1.87 | = +1.80 | + 177 + 11 = +88 | +4.2  |
| 3 | -1.56 | -1.50 | = +1.67 | + 112 + 9 = +121 | +4.6  |
| 4 | -2.10 | -0.50 | = -61   | + 150 + 3 = +153 | -2.14 |
| 5 | -2.16 | 0.00  | = +95   | + 155 - 0 = +155 | -6.0  |
| 6 | -2.10 | +0.50 | = +197  | + 150 - 3 = +152 | +4.5  |
| 7 | -1.54 | +1.50 | = -96   | + 110 - 9 = +101 | -19.7 |
| 8 | -1.08 | +1.87 | = +1.89 | + 177 - 11 = +66 | +9.3  |
| 9 | -0.08 | +2.16 | = +1.62 | + 86 - 13 = -7   | +1.69 |

## Mean Equations:

$$1. -4.07a - 5.75b = +483$$

$$2. -6.19a + 5.28b = +565$$

$$+4.07 - 348 = -372$$

$$-923 = +111$$

$$b = -112.0$$

$$-6.19a = +565 + 64 = +629$$

$$a = -101.5$$

$$5. -6.23 - 5.75b = +578$$

$$+1 - 4.03 + 5.28b = +470$$

$$+6.23 - 897 = -726$$

$$-1392 = -148$$

$$b = +10.6$$

$$-4.03 = +470 - 56 = +414$$

$$a = -102.5$$

## Remeasure Moon

↓ scratch

16.7 159 36  
19.4 1225951  
40  
30  
19.3684

14383  
807968  
70  
99  
3680

15306  
1235155  
565  
09  
16.7047

14974  
792927  
3027  
84  
7052

2  
16.0 149 65  
19.6 867890  
77  
59  
19.6279

14740  
1101119  
1019  
52  
16268

3  
15.5  
20.0

15125  
1039090  
90  
31  
15.5262

15810  
1055048  
4148  
02  
5260

4  
14.9  
21.0

11910  
1177767  
77  
14.9864

1126060  
60  
11140  
9880

5  
14.9  
21.5  
min  
w  
x

11875  
1115360  
55  
14.9281

1189089  
80  
11170  
9284

6  
14.9  
22.0

10863  
1071107  
08  
14.9846

1234048  
5048  
12194  
9848

Moon - Reenewance

a 4 n

d 72

w

$$\begin{array}{r} 7 \\ 155 \\ \hline 230 \end{array}$$

$$\begin{array}{r} 18680 \\ 1409000 \\ 80 \\ 75 \\ \hline 155413 \end{array}$$

$$\begin{array}{r} 18030 \\ 1260598 \\ 00 \\ 36 \\ \hline 5432 \end{array}$$

$$\begin{array}{r} 8 \\ 16.0 \quad 18893 \\ 234 \quad 15257 \\ \quad 4047 \\ \quad 02 \\ \hline 23.3648 \end{array}$$

$$\begin{array}{r} 16980 \\ 1063730 \\ 30 \\ 75 \\ \hline 3653 \end{array}$$

$$\begin{array}{r} 9 \\ 17.04 \quad 17860 \\ 23.6 \quad 1133030 \\ \text{may} \quad 32 \\ \text{in} \quad 60 \\ 8 \quad 23.6529 \\ \hline \end{array}$$

$$\begin{array}{r} 18610 \\ 15141 \\ 5248 \\ 02 \\ \hline 6540 \end{array}$$

## Linear Center

|    | $x$     | $x - x_0$ | $\Delta x$ | $(x - x_0)^2$ | $(x - x_0)^2 + (y - y_0)^2$ | $0 - c$ |
|----|---------|-----------|------------|---------------|-----------------------------|---------|
| 1  | 16.7050 | -0.3800   | -6         | 0.1449        | 4.6720                      | +211    |
| 2  | 16.0000 | -1.0850   | -5         | 1.1783        | 4.6696                      | +187    |
| 3  | 15.5261 | -1.5589   | -4         | 2.4314        | 4.6691                      | +182    |
| 4  | 14.9872 | -2.0978   | -1         | 4.4012        | 4.6472                      | -27     |
| -5 | 14.9282 | -2.1568   | 0          | 4.6517        | 4.6517                      | +8      |
| 6  | 14.9847 | -2.1003   | +1         | 4.4108        | 4.6648                      | +139    |
| 7  | 15.5422 | -1.5428   | +4         | 2.3790        | 4.6407                      | -102    |
| 8  | 16.0000 | -1.0850   | +5         | 1.1762        | 4.6690                      | +181    |
| 9  | 17.0850 | 0.0000    | +6         | 0.0000        | 4.6539                      | +30     |

$$\text{Comp } R^2 = 4.6509$$

|   | $y$     | $y - y_0$ | $\Delta y$ | $(y - y_0)^2$ |
|---|---------|-----------|------------|---------------|
| 1 | 19.3682 | -2.1278   | +1         | 4.5271        |
| 2 | 19.6274 | -1.8686   | +1         | 3.4913        |
| 3 | 20.0000 | -1.4960   | +1         | 2.2377        |
| 4 | 21.0000 | -0.4960   | 0          | 0.2460        |
| 5 | 21.4960 | 0.0000    | 0          | 0.0000        |
| 6 | 22.0000 | +0.5040   | 0          | 0.2540        |
| 7 | 23.0000 | +1.5040   | -1         | 2.2617        |
| 8 | 23.3650 | +1.8690   | -1         | 3.4928        |
| 9 | 23.6534 | +2.1574   | -1         | 4.6539        |

## Approx Center

$$x = 16.0 \quad y = 19.6274$$

$$233650$$

$$429924$$

$$y_0 = 21.4962$$

$$y = \text{max } 23.6534$$

$$R = 21572$$

$$x = \text{min } 14.9282$$

$$x_0 = 17.0854$$

$$\text{Center } \begin{cases} x_0 = 17.0850 \\ y_0 = 21.4960 \end{cases}$$

1462

# Moon's Center - Residuals. Conditional Equations.

|   | a     | b     | c     | 0 - c |
|---|-------|-------|-------|-------|
| 1 | -0.38 | -2.13 | +2.11 | +1.5  |
| 2 | -1.09 | -1.87 | +1.87 | +4.3  |
| 3 | -1.56 | -1.50 | +1.82 | +6.1  |
| 4 | -2.10 | -0.50 | -3.7  | +8.2  |
| 5 | -2.16 | +0.00 | +8    | +8.5  |
| 6 | -2.10 | +0.50 | +1.39 | +8.2  |
| 7 | -1.54 | +1.50 | -1.02 | +6.0  |
| 8 | -1.09 | +1.87 | +1.81 | +4.3  |
| 9 | 0.00  | +2.16 | +3.0  | +0    |

Average = 109

## Normal Equations

$$\begin{aligned}
 +20.77 + 0.84 &= -84.0 \\
 +0.84 + 21.16 &= -73.5 \\
 -0.84 - 0.03 &= +3.4 \\
 +21.13 &= -70.1 \\
 +20.77a &= -84.0 + 28 = -56
 \end{aligned}$$

$$b = -22.2$$

$$a = -39.2$$

## Formation of Normal

|   | ab    | du     | du     | kt | pos. L | residual |
|---|-------|--------|--------|----|--------|----------|
| 1 | +0.81 | -80.2  | -450.0 | 1  | 190.2  | +128     |
| 2 | +2.04 | -204.0 | -349.5 | 2  | 210.2  | +84      |
| 3 | +2.34 | -284.0 | -273.5 | 3  | 226.2  | +73      |
| 4 | +1.05 | +77.7  | +18.5  | 4  | 256.7  | -135     |
| 5 | -0.00 | -17.3  | +0.0   | 5  | 270.0  | -77      |
| 6 | -1.05 | -292.0 | +69.5  | 6  | 283.6  | +73      |
| 7 | -2.31 | +157.0 | -153.0 | 7  | 314.0  | -114     |
| 8 | -2.04 | -197.5 | +338.3 | 8  | 329.8  | +198     |
| 9 | +0.00 | +0.0   | +64.8  | 9  | 0.0    | +100     |
|   | +0.84 | -840.3 | -734.9 |    |        |          |

462

huron's Mean Position (1911.0)

$$\begin{array}{r}
 X_0 = 17.0850 \\
 - 20 \\
 \hline
 17.0830
 \end{array}
 \qquad
 \begin{array}{r}
 Y_0 = 21.4960 \\
 - 16 \\
 \hline
 21.4944
 \end{array}$$

Twinn Plate Constants  $X = 17.0463$   $Y = 21.5754$ 

$$\xi = -0.9537$$

$$\eta = -0.4246$$

$$\begin{array}{r}
 \log \xi = 9.97941 m \\
 - \cos \xi = 9.96612 \\
 \hline
 8.50724
 \end{array}$$

$$\begin{array}{r}
 \log \tan \delta = 9.6136 \\
 9.9588 \\
 7.0534 \\
 \hline
 6.6258
 \end{array}$$

$$(\alpha - A) = 1.50605 m$$

$$\begin{array}{r}
 \eta_1 = 6.6258 \\
 \eta_2 = + 4
 \end{array}$$

$$\alpha - A = - 32.07$$

$$\eta_0 = -0.4250$$

$$A = 3 \ 48 \ 44$$

$$\begin{array}{r}
 \log \eta_0 = 9.62839 m \\
 7.33115
 \end{array}$$

$$\begin{array}{r}
 \alpha_0 = 3 \ 48 \ 11.93 \\
 \hline
 + 3.92
 \end{array}$$

$$(\delta - D) = 2.29724 m$$

$$\delta - D = - 3 \ 18.3$$

$$\alpha' = 3 \ 48 \ 15.85 \checkmark$$

$$D = + 22 \ 23 \ 42$$

$$\delta_0 = + 22^\circ \ 20' \ 23.7$$

$$+ 18.9 \checkmark$$

$$\delta' = + 22 \ 20 \ 42.6 \checkmark$$

Red. ad. l. aph

$$S = 22^{\circ} 20'$$

$$H + \alpha \quad 4 \quad 54 = 73^{\circ} 30'$$

$$H \quad 1 \quad 06$$

$$\alpha = 3 \quad 48$$

$$G \quad 22 \quad 13$$

$$G + \alpha_0 \quad 2 \quad 01 = 30^{\circ} 15'$$

$$L \cos S \quad 99661$$

$$\dots L \quad 04014$$

$$\dots (L) \quad 03675$$

$$L \sin S \quad 95799$$

$$\dots \cos(G + \alpha) \quad 94533$$

$$\dots L \quad 13073$$

$$\dots \sin \dots \quad 99817$$

$$\dots \sec S \quad 00339$$

$$\dots \dots \quad 88239$$

$$L \cos(G + \alpha) = 99364$$

$$\dots g \quad 12234$$

$$\dots \sin \dots = 97022$$

$$\dots \tan S = 96136$$

$$\dots \dots = 88239$$

$$-(g') \quad 11598$$

$$-(g) \quad 93631$$

$$\log(h') \quad 03405$$

$$\dots (h) \quad 01468$$

$$b = +2.29$$

$$g = +0.23$$

$$h = +1.40$$

$$+3.92 \checkmark$$

$$g' = +1445$$

$$h' = +219$$

$$L = +233$$

$$+1897 \checkmark$$



1962 *Lunar parallax*

$$\begin{array}{rcl} \alpha' & = & 3^h 48^m 15.385^s \\ \delta & = & 7 \quad 08 \quad 13.6^s \\ \alpha - \alpha' & = & +3 \quad 19 \quad 57.8^s \\ & = & +49^\circ 59' 27'' \end{array}$$

$$\begin{array}{rcl} & + & 18 \quad 40 \\ & + & 49 \quad 40 \quad 47 \end{array}$$

$$\begin{array}{r} 9.95727 \\ 9.99999 \\ 0.18906 \\ \hline 014632 \end{array}$$

$$\begin{array}{rcl} \delta & = & 54 \quad 28 \quad 28 \\ & & 22 \quad 20 \quad 43 \end{array}$$

$$\delta - \delta' = 32 \quad 07 \quad 45$$

$$\begin{array}{r} 9.82640 \\ 824711 \\ 972577 \\ \hline 0.08945 \\ 7.88873 \end{array}$$

$$\delta - \delta' = +26 \quad 36 \quad 5$$

$$\delta = +22 \quad 47 \quad 19.2$$

$$\text{Am Eph } \delta = +22 \quad 47 \quad 17.9^s$$

$$\delta - \delta' = +1.2$$

$$\delta' = +22^\circ 20' 42.6''$$

$$\Pi = 60' 43.8''$$

$$\begin{array}{r} 9.86913 \\ 824711 \\ 9.88420 \\ \hline 003529 \\ 803573 \end{array}$$

$$\begin{array}{rcl} \alpha - \alpha' & = & +37' 19.58'' \\ & + & 2'' 29.31'' \end{array}$$

$$\alpha = 3 \quad 50 \quad 45.16$$

$$\alpha = 3 \quad 50 \quad 44.62^s$$

$$+ 0.54$$





