

KG  
11366  
v. 757

*Investigations of Circle Errors*  
1881

*Aug 15<sup>th</sup> 1881 - Aug 17<sup>th</sup> 1881*





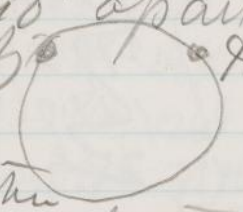






Aug 15 1881

Investigating the errors of the quadrant points of the east-circle. The errors of these points have been determined by reading the microscope for the 4 positions  $\alpha = 0-90$ ,  $\alpha = 90-180$ ,  $\alpha = 180-270$ ,  $\alpha = 270-360$ . In order to get an independent determination free from the errors due to the eccentricity of the pivots, the following plan was pursued.

Point the auxiliary microscope (with iron rays) were set  $90^\circ$  apart in the following position upon the wheel "B"  and B.

They were adjusted to the focus of the divisions of the east-circle. It was found that the divisions remained fairly in focus throughout an entire revolution of the telescope.

Having set the telescope at the zenith, in which case  $\alpha$  reads  $45^\circ$ , the two microscopes were set upon the  $90^\circ$  divisions of the west-circle.

Having read microscopes E, F, G, H the telescope was moved  $90^\circ$  and with the tangent screw set so that the line which was under the cross wire of the microscope B was now under the cross wire of A, E, F, G, H were then read again. This operation was repeated in each quadrant. ~~As a~~ Taking out the constant from the differences of the readings of E, F, G, H gave each end of each quadrant. The residuals were the errors of the east-circle for the quadrant-points.



4

Aug 5 1881

Quadrant peris

 $z = 0$  $z = 0 \quad z = 50$ 

$\begin{array}{r} 2 \\ 7 \\ 9 \\ 16 \end{array}$ 
 $\begin{array}{r} 21.6299 \\ 41.2449 \\ 41.8452 \\ 42.1456 \end{array}$ 
 $\begin{array}{r} 29.2 \\ 51.5 \\ 56.3 \\ 46.5 \end{array}$ 
 $\begin{array}{r} 314 \\ 541 \\ 530 \\ 483 \end{array}$ 
 $\begin{array}{r} 18181656 \\ 1777 \\ 4140 \\ 4442 \end{array}$ 
 $\begin{array}{r} 1868 \\ 46.70 \\ -5.30 \end{array}$

$\begin{array}{r} 90 \\ 317 \\ 541 \\ 529 \\ 486 \\ 1873 \\ 4682 \end{array}$ 
 $\begin{array}{r} 180 \\ 407 \\ 21 \\ 56.5 \\ 508 \\ 2501 \\ 5252 \end{array}$ 
 $\begin{array}{r} -5.70 \end{array}$

$\begin{array}{r} 180 \\ 406 \\ 2.3 \\ 56.8 \\ 513 \\ 2100 \\ 5250 \end{array}$ 
 $\begin{array}{r} 270 \\ 50.2 \\ 6.1 \\ 59.0 \\ 514 \\ 2367 \\ 5918 \end{array}$ 
 $\begin{array}{r} -6.68 \end{array}$

$\begin{array}{r} 270 \\ 504 \\ 64 \\ 59.0 \\ 10 \end{array}$ 
 $\begin{array}{r} 360 \\ 534 \\ 80 \\ 96 \\ 100 \end{array}$ 
 $\begin{array}{r} 8775 \\ 6525 \end{array}$

$\begin{array}{r} 170 \\ 312 \\ 329 \\ 330 \\ 1141 \\ 2852 \end{array}$ 
 $\begin{array}{r} 17.9 \\ 40.3 \\ 39.6 \\ 35.1 \\ 1329 \\ 3322 \end{array}$ 
 $\begin{array}{r} -470 \end{array}$

$\begin{array}{r} 90 \\ 179 \\ 40.5 \\ 40.0 \\ 35.0 \\ 1334 \\ 3335 \end{array}$ 
 $\begin{array}{r} 180 \\ 261 \\ 473 \\ 424 \\ 358 \\ 1516 \\ 3790 \end{array}$ 
 $\begin{array}{r} -4.55 \end{array}$

$\begin{array}{r} 180 \\ 261 \\ 477 \\ 424 \\ 35.3 \\ 1515 \\ 3788 \end{array}$ 
 $\begin{array}{r} 270 \\ 345 \\ 503 \\ 43.1 \\ 40.5 \\ 1534 \\ 4335 \end{array}$ 
 $\begin{array}{r} 547 \end{array}$

$\begin{array}{r} 270 \\ 348 \\ 506 \\ 431 \\ 456 \\ 1735 \\ 4338 \end{array}$ 
 $\begin{array}{r} 0 \\ 36.6 \\ 51.3 \\ 52.9 \\ 53.3 \\ 1941 \\ 4852 \end{array}$ 
 $\begin{array}{r} 5.14 \end{array}$

$\begin{array}{r} 496 \\ 648 \\ 66 \\ 671 \end{array}$ 
 $\begin{array}{r} 958115 \\ 249233 \\ 2544319 \\ 26022878 \end{array}$ 
 $\begin{array}{r} 100 \\ 329 \\ 319 \\ 325 \end{array}$ 
 $\begin{array}{r} 150548 \\ 35280 \\ 365168 \\ 375128 \end{array}$ 
 $\begin{array}{r} 8564610 \\ 261227 \\ 256530 \\ 420650 \end{array}$ 
 $\begin{array}{r} 86.8 \end{array}$

$\begin{array}{r} 100102 \\ 33.378 \\ 318364 \\ 278324 \\ 10251218 \\ 25643045 \end{array}$ 
 $\begin{array}{r} 110281 \\ 49.6 \\ 444 \\ 382 \\ 1603 \\ 4007 \end{array}$ 
 $\begin{array}{r} 9.62 \end{array}$

$\begin{array}{r} 280 \\ 498 \\ 441 \\ 381 \\ 1610 \\ 4025 \end{array}$ 
 $\begin{array}{r} 423 \\ 584 \\ 506 \\ 535 \\ 2048 \\ 5120 \end{array}$ 
 $\begin{array}{r} 1098 \end{array}$

$\begin{array}{r} 432 \\ 595 \\ 518 \\ 539 \\ 2084 \end{array}$ 
 $\begin{array}{r} 499 \\ 642 \\ 660 \\ 670 \\ 2471 \end{array}$ 
 $\begin{array}{r} 6178 \end{array}$

Focus band 9.68



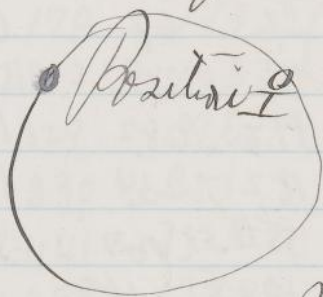
| 2=0   | 2=90              | 0     | 90    | 0     | 90    | 0     | 90    |
|-------|-------------------|-------|-------|-------|-------|-------|-------|
| 1.8   | 4.4 <sup>30</sup> | 2.0   | 7.0   | 2.6   | 6.2   | 0.8   | 5.0   |
| 17.4  | 27.1              | 17.1  | 29.8  | 16.8  | 28.9  | 15.6  | 27.9  |
| 18.4  | 26.0              | 18.4  | 28.8  | 17.8  | 28.2  | 16.5  | 27.0  |
| 17.9  | 21.2              | 18.4  | 24.2  | 18.2  | 23.4  | 17.1  | 22.0  |
| 55.5  | 88.7              | 55.9  | 89.8  | 55.4  | 86.7  | 50.0  | 81.9  |
| 138.8 | 196.8             | 139.8 | 224.5 | 138.5 | 216.8 | 125.0 | 204.8 |
|       | 5.80              |       | 8.47  |       | 7.83  |       | 7.98  |
|       | <sup>73</sup> 880 |       |       |       |       |       |       |

|       |       |       |       |       |       |       |                      |
|-------|-------|-------|-------|-------|-------|-------|----------------------|
| 4.3   | 16.2  | 6.9   | 19.8  | 6.5   | 19.6  | 5.0   | <del>17.8</del> 17.1 |
| 27.2  | 37.7  | 29.8  | 41.4  | 29.0  | 41.0  | 27.8  | 38.5 38.7            |
| 25.9  | 32.5  | 28.3  | 35.9  | 28.1  | 35.8  | 27.0  | 33.4 33.2            |
| 21.2  | 25.9  | 24.0  | 29.8  | 23.9  | 29.2  | 22.0  | 26.5 26.0            |
| 78.6  | 112.3 | 89.0  | 126.9 | 87.5  | 125.6 | 81.8  | 117.1 115.4          |
| 196.8 | 280.8 | 222.5 | 317.5 | 218.8 | 314.0 | 204.5 | <del>287</del> 288.5 |
|       | 84.0  |       | 9.50  |       | 9.52  |       | 84.0                 |

|       |       |       |       |       |       |       |       |
|-------|-------|-------|-------|-------|-------|-------|-------|
| 16.3  | 29.9  | 20.1  | 33.3  | 19.8  | 33.3  | 18.1  | 31.6  |
| 37.8  | 46.0  | 41.0  | 49.2  | 41.3  | 49.7  | 38.7  | 46.9  |
| 32.3  | 39.0  | 35.9  | 41.7  | 35.7  | 41.9  | 33.2  | 39.6  |
| 25.7  | 40.9  | 29.7  | 44.1  | 29.2  | 44.0  | 26.0  | 41.2  |
| 112.1 | 155.8 | 126.7 | 168.3 | 126.0 | 168.9 | 115.0 | 159.3 |
| 280.2 | 389.5 | 316.8 | 420.8 | 315.0 | 422.2 | 287.5 | 398.2 |
|       | 10.3  |       | 10.40 |       | 10.72 |       | 11.07 |

|       |       |       |       |       |                   |       |       |
|-------|-------|-------|-------|-------|-------------------|-------|-------|
| 30.1  | 36.2  | 33.7  | 38.8  | 30.6  | 49.6 39.2         | 31.7  | 37.3  |
| 46.1  | 51.0  | 49.3  | 53.3  | 49.6  | <del>4</del> 54.1 | 47.0  | 52.1  |
| 38.8  | 52.3  | 42.0  | 55.0  | 41.6  | 55.1              | 39.3  | 53.5  |
| 40.9  | 53.0  | 44.1  | 55.3  | 44.0  | 55.9              | 41.7  | 54.0  |
| 158.9 | 192.5 | 169.1 | 202.4 | 168.8 | 204.3             | 159.7 | 196.9 |
| 389.8 | 481.2 | 422.8 | 506.0 | 422.0 | 510.8             | 399.2 | 492.2 |
|       | 9.14  |       | 8.32  |       | 8.88              |       | 9.30  |

Recapitulation of position I of microscopes of films



Mo

|       |      |       |       |       |       |       |        |       |
|-------|------|-------|-------|-------|-------|-------|--------|-------|
| -8.30 | 8.70 | 8.68  | 8.80  | 8.47  | 7.83  | 7.98  | -8.39  | -0.80 |
| -8.70 | 8.55 | 9.62  | 8.40  | 9.00  | 9.02  | 8.40  | -8.96  | -0.23 |
| -9.68 | 9.47 | 10.88 | 10.53 | 10.40 | 10.72 | 11.07 | -10.32 | +1.13 |
| -9.00 | 9.14 | 9.68  | 9.14  | 8.32  | 8.88  | 9.30  | -9.07  | -1.2  |
|       |      |       |       |       |       |       | -9.19  |       |

In order to see whether different results would be obtained by a different position of the two microscopes A and B they were placed in the following position



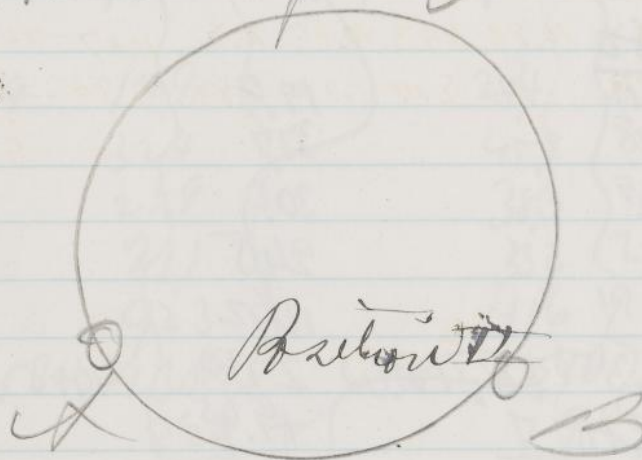
If there is any flattening of the circle at (a) the moving point of the meridian will approach a straight line and the distance moved over will be too small. On the other hand at (b) the distance moved over by the point will be too great.



|          |                |                |
|----------|----------------|----------------|
|          | 2 = 6          | 90             |
| $\Sigma$ | 41             | 29             |
| $\Sigma$ | 176            | 241            |
| $\Sigma$ | 165            | 212            |
| $\Sigma$ | 181            | 182            |
|          | 563            | 664            |
|          | 1498           | 1660           |
|          | <del>181</del> | <del>252</del> |
|          | 91             | 180            |
| $\Sigma$ | 81             | 211            |
| $\Sigma$ |                | 411            |
| $\Sigma$ |                | 388            |
| $\Sigma$ |                | 292            |
|          |                | 1252           |
|          | 1660           | 3180           |
|          |                | 0              |

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microns



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| 00   | 90    | 0     | 20      |      |      |                |       |       |  |
|------|-------|-------|---------|------|------|----------------|-------|-------|--|
| 251  | 141   | 339   | 230     | 414  | 309  | 369            | 245   |       |  |
| 390  | 362   | 480   | 451     | 559  | 532  | 571            | 474   |       |  |
| 374  | 353   | 476   | 415     | 543  | 490  | 495            | 430   |       |  |
| 385  | 255   | 481   | 382     | 562  | 463  | 515            | 401   |       |  |
| 1404 | 1131  | 1776  | 1478    | 2078 | 1794 | 1890           | 1550  |       |  |
| 3570 | 2828  | 4440  | 3895    | 5195 | 4485 | 4725           | 3875  |       |  |
|      | +682  |       | +745    |      | 710  |                | 850   |       |  |
| 90   | 180   |       |         |      |      |                |       |       |  |
| 143  | 112   |       | 17.0    |      | 25.9 | <del>176</del> | 19.6  |       |  |
| 363  | 318   |       | 377     |      | 466  |                | 40.7  |       |  |
| 331  | 239   |       | 30.9    |      | 38.1 |                | 32.5  |       |  |
| 297  | 185   |       | 245     |      | 333  |                | 27.1  |       |  |
| 113  | 854   |       | 1092    |      | 1439 |                | 1199  |       |  |
| 2835 | 21.35 | 3695  | 2730    | 4485 | 3595 | 3875           | 2998  |       |  |
| 180  | +7.00 |       | +9.65   |      | 890  |                | 8.77  |       |  |
| 111  | 91    |       | 8.0     |      | 20.7 |                | 14.7  |       |  |
| 319  | 241   |       | 8.29    |      | 36.0 |                | 29.9  |       |  |
| 239  | 142   |       | 13.1    |      | 25.6 |                | 19.5  |       |  |
| 190  | 179   |       | 16.4    |      | 29.2 |                | 23.0  |       |  |
| 8.59 | 653   |       | 7.04    |      | 1115 |                | 8.1   |       |  |
| 2148 | 1635  | 2730  | 704     | 3595 | 2788 | 2998           | 2178  |       |  |
|      | +487  |       | 1760    |      | 8.07 |                | 8.20  |       |  |
|      |       |       | 9.70    |      |      |                |       |       |  |
| 270- | 0     |       |         |      |      |                |       |       |  |
| 92   | 591   |       | 565     |      | 98   |                | 36    |       |  |
| 240  | 129   |       | 92      |      | 23.5 |                | 17.5  |       |  |
| 142  | 122   |       | 82      |      | 22.1 |                | 15.9  |       |  |
| 77   | 139   |       | 101     |      | 240  |                | 18.1  |       |  |
| 1641 | 381   | 17760 | 23838   | 2788 | 794  |                | 55.1  |       |  |
| 1628 | 9.52  |       | 58.65   |      | 1965 |                | 21.78 | 13.75 |  |
|      | +676  |       | 3.88165 |      | 8.23 |                | 8.03  |       |  |



| 0     | 90                   |                     |       |       |       |                      |       |
|-------|----------------------|---------------------|-------|-------|-------|----------------------|-------|
| 3.5   | <del>522</del> 5.22  | 28.5                | 17.7  | 39.2  | 29.1  | 400                  | 29.6  |
| 11.5  | <del>42</del> 14.2   | 42.9                | 39.0  | 53.7  | 5.14  | 54.4                 | 51.9  |
| 16.1  | <del>11.7</del> 11.2 | 42.0                | 36.0  | 52.8  | 4.82  | 53.5                 | 49.0  |
| 18.0  | <del>7.8</del> 7.8   | 43.1                | 33.0  | 53.8  | 4.48  | 52.9                 | 45.1  |
| 53.1  | 26.54                | 156.5               | 125.2 | 199.5 | 178.5 | 202.8                | 185.8 |
| 132.8 | 66.30                | 39.12               | 313.0 | 498.8 | 433.8 | 507.0                | 439.5 |
|       | 6.93                 |                     | 17.82 |       | 6.50  |                      | 4.25  |
|       |                      |                     |       |       |       |                      | 6.75  |
| 498.8 | 45.0                 | <del>129</del> 12.9 |       |       | 24.4  | <del>24.0</del> 24.0 | 26.0  |
| 11.9  | 5.8                  |                     | 32.4  |       | 45.7  |                      | 46.7  |
| 8.4   | 5.4                  |                     | 25.9  |       | 38.3  |                      | 39.0  |
| 5.8   | 5.27                 |                     | 2.11  |       | 33.2  |                      | 34.1  |
| 25.6  | 22.09                |                     | 92.3  |       | 14.6  |                      | 14.58 |
| 639.0 | 55.22                | 31.30               | 230.8 | 433.8 | 354.0 | 439.5                | 364.5 |
|       | 8.68                 |                     | 8.22  |       | 7.98  |                      | 7.50  |
|       | 39.3                 |                     | 8.9   |       | 20.8  |                      | 22.2  |
|       | 54.5                 |                     | 23.8  |       | 36.3  |                      | 37.9  |
|       | 44.6                 |                     | 15.0  |       | 26.9  |                      | 28.3  |
|       | 49.0                 |                     | 18.4  |       | 30.1  |                      | 32.0  |
|       | 18.4                 |                     | 6.61  |       | 11.41 |                      | 12.05 |
| 55.22 | 46.85                | 23.08               | 16.52 | 354.0 | 285.2 | 364.5                | 30.12 |
|       | 8.87                 |                     | 6.56  |       | 6.88  |                      | 6.33  |
|       |                      |                     |       |       |       |                      |       |
|       | 28.2                 |                     | 59.1  |       | 9.8   |                      | 10.8  |
|       | 42.1                 |                     | 13.0  |       | 23.8  |                      | 24.9  |
|       | 41.0                 |                     | 12.3  |       | 23.1  |                      | 24.0  |
|       | 43.5                 |                     | 13.7  |       | 24.8  |                      | 25.2  |
|       | 15.48                |                     | 27.81 |       | 8.15  |                      | 8.49  |
| 46.85 | 38.70                | 16.52               | 69.52 | 285.2 | 203.8 | 301.22               | 22.22 |
|       | 8.15                 |                     | 7.00  |       | 8.14  |                      | 7.90  |



Continued

|                |             |      |      |      |      |      |      |
|----------------|-------------|------|------|------|------|------|------|
| 382            | 27.9        | 421  | 321  | 337  | 246  | 406  | 325  |
| 524            | 49.2        | 563  | 541  | 480  | 469  | 552  | 550  |
| 577            | 475         | 554  | 518  | 469  | 435  | 539  | 523  |
| 531            | 440         | 569  | 482  | 481  | 408  | 559  | 485  |
| 1954           | 1686        | 2107 | 1862 | 1767 | 1558 | 2056 | 1883 |
| 4885           | 4215        | 5268 | 4645 | 4418 | 3895 | 5140 | 4708 |
|                | 670         |      | 6.13 |      | 5.23 |      | 4.36 |
| <u>90</u>      | <u>180</u>  |      |      |      |      |      |      |
| <del>244</del> | 244         |      | 280  |      | 210  |      | 296  |
|                | 45.3        |      | 490  |      | 420  |      | 509  |
|                | 38.5        |      | 415  |      | 348  |      | 433  |
|                | 336         |      | 360  |      | 294  |      | 383  |
|                | 1418        |      | 1545 |      | 1272 |      | 1621 |
| 4215           | 3545        | 4655 | 3862 | 3895 | 3280 | 4705 | 4052 |
|                | 670         |      | 7.93 |      | 6.15 |      | 6.56 |
| <u>180</u>     | <u>270</u>  |      | 253  |      |      |      |      |
|                | 209         |      | 408  |      | 187  |      | 279  |
|                | 863         |      | 219  |      | 338  |      | 427  |
|                | 271         |      | 342  |      | 243  |      | 336  |
|                | 298         |      | 1222 |      | 280  |      | 368  |
|                | 1141        | 3862 | 3305 |      | 1048 |      | 1410 |
| 3545           | 2852        |      | 857  | 3280 | 2620 | 4052 | 3520 |
|                | 690         |      | 5.57 |      | 560  |      | 532  |
| <u>270</u>     | <u>1000</u> |      | 157  |      | 9.5  |      | 173  |
|                | 110         |      | 295  |      | 235  |      | 312  |
|                | 257         |      | 287  |      | 231  |      | 311  |
|                | 249         |      | 302  |      | 243  |      | 323  |
|                | 256         |      | 1035 |      | 804  |      | 1119 |
|                | 866         | 3055 | 2588 |      | 2620 | 2520 | 2998 |
| 2852           | 2165        |      | 4.67 |      | 2010 |      | 7.22 |
|                | 6.87        |      |      |      | 6.10 |      |      |



|       |      |      |      |      |      |      |      |      |      |      |       |       |     |
|-------|------|------|------|------|------|------|------|------|------|------|-------|-------|-----|
| +6.82 | 7.15 | 8.10 | 6.93 | 7.82 | 6.50 | 6.75 | 6.70 | 6.13 | 5.23 | 4.36 | Mean  | +6.63 | +36 |
| +7.00 | 8.80 | 8.77 | 8.68 | 8.22 | 7.58 | 7.52 | 6.70 | 7.93 | 6.15 | 6.56 | +7.67 | -1.27 |     |
| +5.87 | 8.07 | 8.20 | 8.37 | 6.56 | 6.58 | 6.33 | 6.90 | 5.57 | 5.40 | 5.32 | +6.65 | +34   |     |
| +6.76 | 8.23 | 8.03 | 8.18 | 7.00 | 8.14 | 7.90 | 6.87 | 4.67 | 6.10 | 7.22 | +7.01 | -.02  |     |
|       |      |      |      |      |      |      |      |      |      |      | 6.99  |       |     |

Combination of results for the two positions of the microscopes.

| I     | II   | Mean  |
|-------|------|-------|
| -.80  | +.36 | -.022 |
| -.23  | -.67 | -.045 |
| +1.13 | +.34 | +0.73 |
| -.12  | -.02 | -.007 |

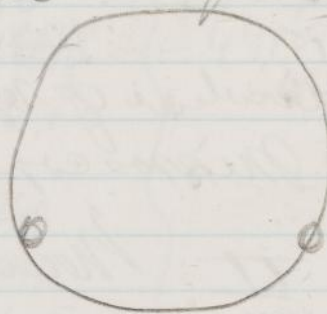
If the pivots are eccentric  
It will be seen from the above that the evidence of a change depending on the position of the microscopes is not very conclusive.

If the pivots of the instrument are eccentric the position of the points of the new circle which passes for B to it will not be an arc of a circle, but by making the investigation from points of the circle this error will be eliminated. On the following measurement the new circle was moved forward 90° after each determination.

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Def - The Circle from ~~S~~ <sup>to</sup> pointing  
South to ~~S~~ <sup>new</sup> pointing to the <sup>new</sup> ~~circle~~ <sup>circle</sup> ~~circle~~.

Microscopy





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|       |      |
|-------|------|
| 0°    | 90°  |
| 344   | 380  |
| 49.1  | 59.7 |
| 8.1   | 57.0 |
| 49.1  | 54.7 |
| 180.7 | 2094 |
| 4518  | 5235 |
| -717  |      |

|      |      |
|------|------|
| 90   | 180  |
| 488  | 488  |
| 9.6  |      |
| 3.2  |      |
| 57.5 |      |
| 291  |      |
| 5235 | 5978 |

-443

180 270

|       |
|-------|
| 594   |
| 15.6  |
| 6.5   |
| 9.5   |
| 270   |
| 5978  |
| 6775  |
| -7.97 |

50

196

190

202

638

|       |      |
|-------|------|
| 17.71 | 1595 |
| -820  |      |

|      |      |
|------|------|
| 0    | 90   |
| 204  | 25.7 |
| 34.6 | 47.7 |
| 34.1 | 45.0 |
| 354  | 42.2 |
| 1245 | 1606 |
| 3112 | 4015 |
| -903 |      |

36.5 +1.0

57.2

50.9

456

1902

4015 4855

-8.40

483

40

55.3

58.5

2261

47.50 56.52

9.02

54.6

50.46

9.2

9.0

10.6

2624

5652 6585

9.33

|      |      |
|------|------|
| 129  | 191  |
| 274  | 41.3 |
| 26.9 | 39.0 |
| 289  | 36.1 |
| 961  | 1355 |
| 2402 | 3388 |
| 9.86 |      |

31.9

530

45.7

410

1916

3388 4290

9.02

441

54

51.5

55.2

2112

-4290 5280

9.90

49.9

49.0

4.9

6.0

2458

5280 6145

8.65

|      |      |
|------|------|
| 80   | 140  |
| 22.2 | 37.0 |
| 21.5 | 35.0 |
| 23.9 | 31.4 |
| 760  | 1174 |
| 1900 | 2935 |
| 9.35 |      |

~~272~~ 488 272

488

411

36.3

1534

2935 3885

9.00

410

57.2

47.2

51.5

1969

3835 4922

10.87

47.8

25

21

4.0

2364

4922 5910

9.88

Continued

|        |       |        |       |        |       |
|--------|-------|--------|-------|--------|-------|
| 10.6   | 17.9  | 14.1   | 21.3  | 2.20   | 29.2  |
| 24.9   | 10.5  | 28.2   | 44.3  | 35.9   | 5.20  |
| 23.9   | 38.0  | 28.0   | 41.6  | 35.9   | 49.1  |
| 26.5   | 35.0  | 29.7   | 38.0  | 32.0   | 46.9  |
| 88.9   | 131.4 | 100.0  | 146.2 | 130.8  | 17.72 |
| 214.8  | 328.5 | 25.00  | 36.55 | 32.70  | 443.0 |
| -10.37 |       | -10.55 |       | -11.60 |       |

|       |       |       |        |        |
|-------|-------|-------|--------|--------|
| 31.0  | 21.3  | 35.0  | 2      | 43.1   |
| 52.5  | 44.3  | 57.1  |        | 5.0    |
| 44.9  | 41.6  | 48.5  |        | 57.5   |
| 40.2  | 39.0  | 45.0  |        | 52.9   |
| 168.6 | 146.2 | 167.0 |        | 21.85  |
| 328.5 | 2.5   | 36.55 | 443.0  | 54.62  |
| -9.30 |       | 36.55 | -10.20 | -10.32 |

|        |       |       |       |
|--------|-------|-------|-------|
| 44.9   | 35.7  | 50.1  | 58.1  |
| 0.9    | 57.1  | 5.8   | 14.1  |
| 51.4   | 49.5  | 56.1  | 4.3   |
| 55.8   |       | 0.8   | 7.3   |
| 21.30  |       | 23.28 | 24.38 |
| 42.5   | 46.75 | 58.20 | 54.62 |
| -11.10 |       | 11.45 | 65.95 |
|        |       |       | 11.33 |

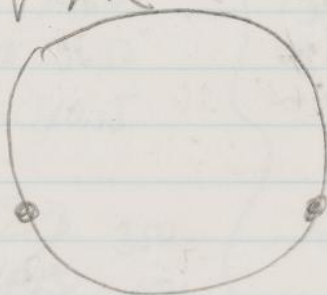
|       |       |       |
|-------|-------|-------|
| 51.1  | 57.1  | 5.2   |
| 5.2   | 11.2  | 19.6  |
| 4.9   | 10.2  | 18.6  |
| 7.1   | 13.0  | 20.7  |
| 24.83 | 27.15 | 64.1  |
| 53.4  | 58.20 | 65.35 |
| 62.08 | 67.88 | 160.2 |
| 8.73  | 9.65  | 10.63 |



$-7.17 - 9.03 - 9.86 - 9.35 - 10.37 - 10.55 - 11.60 - 9.70 + 12$   
 $-7.43 - 8.40 - 9.02 - 9.00 - 9.30 - 10.20 - 10.32 - 9.09 - 49$   
 $-7.97 - 9.02 - 9.90 - 10.87 - 11.10 - 11.45 - 11.33 - 10.23 + 65$   
 $-8.20 - 9.33 - 8.65 - 9.88 - 8.73 - 9.68 - 10.63 - 9.30 + 28$   
 $- 9.58$

Aug 16  
 Moved the circle <sup>new west circle</sup> pointing to the  
 new ~~to~~ pointing north.

Microcup





Aug 16

|       |        |       |                |       |       |       |       |                 |       |
|-------|--------|-------|----------------|-------|-------|-------|-------|-----------------|-------|
| 0     | 90     |       |                |       |       |       |       |                 |       |
| 14.9  | 18.6   | 138   | <del>189</del> | 175   | 230   | 131   | 162   | 10.5            | 14.3  |
| 28.1  | 35.8   | 26.2  | 40.2           | 30.5  | 44.1  | 26.0  | 37.3  | 23.4            | 35.9  |
| 25.4  | 35.7   | 24.2  | 35.9           | 27.9  | 39.8  | 23.9  | 33.1  | 21.2            | 31.5  |
| 28.1  | 33.2   | 27.2  | 33.5           | 30.5  | 37.5  | 26.8  | 30.5  | 24.2            | 29.0  |
| 96.5  | 127.3  | 91.4  | 128.5          | 10.64 | 144.4 | 89.8  | 117.1 | 79.3            | 110.7 |
| 24.12 | 31.82  | 22.85 | 32.12          | 26.60 | 36.16 | 22.45 | 29.28 | 19.82           | 28.68 |
|       | -7.70  |       | -9.27          |       | -9.50 |       | -6.83 |                 | -7.76 |
| 90    | 180    |       |                |       |       |       |       |                 |       |
|       | 26.4   |       | 29.0           |       | 33.3  | 16.2  | 24.4  | <del>22.9</del> | 22.9  |
|       | 46.4   |       | 49.3           |       | 53.6  |       | 44.0  | <del>33.8</del> | 42.0  |
|       | 37.2   |       | 40.0           |       | 44.2  |       | 35.0  | <del>28.9</del> | 34.0  |
|       | 33.0   |       | 35.9           |       | 40.0  |       | 31.0  | <del>26.2</del> | 29.6  |
|       | 1430   |       | 1542           |       | 1711  |       | 1344  | <del>23.2</del> | 128.5 |
| 31.8  | 23.575 | 32.12 | 38.55          | 36.10 | 42.78 | 29.28 | 33.60 | <del>27.6</del> | 32.12 |
|       | 3.53   |       | 6.43           |       | 6.68  |       | 4.32  |                 | 4.44  |
| 180   | 270    |       |                |       |       |       |       |                 |       |
|       | 38.1   |       | 43.9           |       | 48.8  |       | 38.1  | <del>33</del>   | 38    |
|       | 52.2   |       | 58.4           |       | 33    |       | 52.3  |                 | 47.9  |
|       | 41.7   |       | 47.0           |       | 51.9  |       | 41.2  |                 | 36.6  |
|       | 45.6   |       | 52.0           |       | 56.2  |       | 45.7  |                 | 41.0  |
|       | 1776   |       | 2013           |       | 2202  |       | 1773  |                 | 1593  |
| 35.75 | 44.40  | 38.55 | 50.23          | 42.78 | 55.05 | 33.60 | 44.32 | 29.08           | 39.82 |
|       | 8.65   |       | 11.68          |       | 11.27 |       | 10.72 |                 | 16.74 |
| 270   | 360    |       |                |       |       |       |       |                 |       |
|       | 41.2   |       | 47.7           |       | 53.1  |       | 40.0  | 43.9            | 44.9  |
|       | 54.3   |       | 11             |       | 6.0   |       | 53.1  | 54.9            | 58.1  |
|       | 52.0   |       | 58.4           |       | 39    |       | 50.4  | 47.4            | 53.7  |
|       | 54.8   |       | 10             |       | 6.6   |       | 53.0  | 57.5            | 58.4  |
|       | 2023   |       | 2282           |       | 2496  |       | 2065  | 20.7            | 25.42 |
| 44.40 | 50.58  | 50.23 | 57.05          | 50.5  | 62.40 | 44.32 | 51.62 | 35              | 43.70 |
|       | 6.18   |       | 6.82           |       | 7.35  |       | 7.30  |                 |       |



22

Continued

0 90

|      |       |      |       |
|------|-------|------|-------|
| 128  | 16.3  | 10.3 | 15.3  |
| 260  | 37.7  | 25.0 | 38.2  |
| 236  | 33.7  | 23.7 | 35.0  |
| 259  | 31.0  | 24.6 | 31.7  |
| 883  | 118.7 | 83.6 | 120.2 |
| 2208 | 2968  | 2090 | 30.05 |
|      | 7.66  |      | -9.15 |

|          |             |
|----------|-------------|
| 241      | 25.9        |
| 44.4     | 47.1        |
| 35.6     | 89.0        |
| 31.1     | 34.1        |
| 135.2    | 146.1       |
| 29683380 | 30.05 36.52 |
| 4.12     | 6.47        |

|       |            |
|-------|------------|
| 38.1  | 36.9       |
| 52.8  | 52.6       |
| 41.1  | 42.7       |
| 45.9  | 46.1       |
| 179.9 | 17.83      |
| 3380  | 44.48      |
| 106.8 | 44.58      |
|       | 36.52 80.6 |

|       |       |
|-------|-------|
| 40.4  | 39.6  |
| 54.0  | 54.2  |
| 57.0  | 52.6  |
| 53.9  | 54.8  |
| 199.3 | 201.2 |
| 4448  | 4458  |
| 4981  | 50.30 |
| 5.33  | 5.72  |

|       |       |      |       |       |       |
|-------|-------|------|-------|-------|-------|
| 9.4   | 23.2  | 11.7 | 11.3  | 13.9  | 14.9  |
| 23.0  | 44.5  | 25.8 | 32.9  | 24.0  | 35.6  |
| 20.0  | 40.1  | 23.1 | 28.6  | 25.0  | 31.6  |
| 23.0  | 37.7  | 25.2 | 26.0  | 24.1  | 29.0  |
| 75.4  | 14.55 | 8.8  | 9.88  | 9.30  | 11.11 |
| 188.5 | 36.38 | 24.5 | 24.70 | 23.25 | 27.88 |
|       | 17.53 |      | 3.25  |       | 4.53  |

|       |       |       |
|-------|-------|-------|
| 41.1  | 19.8  | 22.7  |
| 12    | 39.6  | 42.6  |
| 52.0  | 31.1  | 33.5  |
| 47.8  | 26.5  | 29.0  |
| 202.1 | 11.70 | 12.78 |
| 36.38 | 24.70 | 29.25 |
| 50.52 |       | 27.83 |
| 14.14 | 4.55  | 4.17  |

|       |       |
|-------|-------|
| 29.0  | 30.6  |
| 43.9  | 45.0  |
| 32.8  | 33.9  |
| 36.9  | 38.5  |
| 142.6 | 148.0 |
| 29.15 | 31.85 |
| 35.65 | 37.00 |
| 6.40  | 5.05  |

|       |       |
|-------|-------|
| 31.1  | 31.8  |
| 44.1  | 45.3  |
| 42.1  | 42.8  |
| 44.8  | 45.5  |
| 162.1 | 166.4 |
| 356.5 | 370.0 |
| 40.52 | 41.60 |
| 4.87  | 4.60  |

Adjusted positions of both microscopes  
Clamped circular



| 93    | 96   | 110  | 113  | 95   | 101  | Mean  |      |      |      |      |             |
|-------|------|------|------|------|------|-------|------|------|------|------|-------------|
| 224   | 30.7 | 241  | 32.4 | 226  | 31.3 | -3.25 | 4.55 | 3.83 | 4.05 | 4.38 | -4.03 - .61 |
| 203   | 26.3 | 215  | 28.0 | 202  | 27.0 | -4.55 | 4.17 | 4.37 | 4.98 | 5.15 | -4.64 + .00 |
| 229   | 24.0 | 242  | 25.3 | 230  | 24.4 | -6.40 | 5.05 | 4.38 | 5.27 | 5.30 | -5.28 + .64 |
| 249   | 40.6 | 808  | 9.0  | 753  | 92.8 | 4.87  | 4.60 | 4.60 | 4.67 | 4.37 | -4.62 - .02 |
| 2272  | 2265 | 2020 | 2425 | 1882 | 2320 |       |      |      |      |      | -4.64       |
| 18.72 | 3.93 |      | 4.05 |      | 4.38 |       |      |      |      |      |             |

|       |                 |       |       |
|-------|-----------------|-------|-------|
| 17.5  | <del>14.4</del> | 23.2  | 19.0  |
| 37.4  | 35.9            | 43.3  | 38.6  |
| 28.9  | 31.2            | 34.1  | 30.1  |
| 24.3  | 28.9            | 29.7  | 25.5  |
| 108.1 | 110.4           | 130.3 | 113.4 |
| 2265  | 2760            | 3258  | 2300  |
| 4.37  |                 | 4.98  | 5.15  |

|       |       |       |
|-------|-------|-------|
| 25.2  | 31.4  | 27.2  |
| 39.4  | 46.0  | 41.8  |
| 28.2  | 34.9  | 30.4  |
| 32.8  | 39.1  | 35.2  |
| 125.6 | 151.4 | 134.6 |
| 2702  | 3258  | 2835  |
| 31.40 | 3785  | 3365  |
| 4.38  | 5.27  | 5.30  |

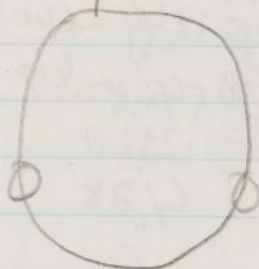
|       |       |       |
|-------|-------|-------|
| 26.6  | 33.0  | 28.8  |
| 39.4  | 46.3  | 41.6  |
| 37.9  | 44.0  | 39.5  |
| 40.1  | 46.8  | 42.2  |
| 144.0 | 170.1 | 152.1 |
| 3000  | 3785  | 3065  |
| 3600  | 4252  | 3802  |
| 4.60  | 4.67  | 4.37  |

24

Aug 6

Moved circle from <sup>new quercus</sup> faintly north  
to ~~of~~ pointing to the radio  
new.

Microscopes





|        |       |       |       |       |       |       |       |       |       |
|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 0      | 90    |       |       |       |       |       |       |       |       |
| 28.1   | 16.5  |       |       | 377.1 | 30.9  | 29.4  | 22.1  | 310   | 23.3  |
| 36.9   | 37.4  | 326   | 25.2  | 37.1  | 52.4  | 42.8  | 43.5  | 44.8  | 45.3  |
| 34.6   | 33.4  | 46.2  | 47.0  | 48.5  | 47.6  | 40.3  | 39.6  | 42.0  | 40.8  |
| 37.0   | 31.1  | 43.4  | 42.2  | 51.2  | 45.1  | 42.8  | 37.1  | 44.8  | 38.0  |
| 131.6  | 16.4  | 46.3  | 39.2  | 187.8 | 17.6  | 155.3 | 42.3  | 162.6 | 147.4 |
| 32.9   | 29.6  | 16.85 | 153.6 | 4.69  | 44.0  | 38.8  | 33.8  | 40.5  | 36.8  |
|        | +3.30 | 42.2  | 38.40 |       | +2.95 |       | +3.24 |       | +3.80 |
| 90     | 180   |       | +3.72 |       |       |       |       |       |       |
|        | 170   | 24.9  |       | 29.4  |       | 22.2  |       | 23.1  |       |
| Add 10 | 37.1  | 44.4  |       | 49.4  |       | 42.4  |       | 43.3  |       |
|        | 28.0  | 35.9  |       | 40.6  |       | 33.3  |       | 34.4  |       |
|        | 23.9  | 30.6  |       | 36.5  |       | 29.0  |       | 30.1  |       |
|        | 106.0 | 135.4 |       | 156.5 |       | 126.9 |       | 130.9 |       |
| 29.60  | 26.50 | 38.40 | 33.80 | 44.00 | 39.12 | 35.58 | 31.72 | 36.85 | 32.72 |
|        | +3.10 |       | +4.55 |       | 4.88  |       | 3.86  |       | 4.13  |
| 180    | 270   |       |       |       |       |       |       |       |       |
|        | 18.6  | 23.9  |       | 27.9  |       | 21.1  |       | 22.5  |       |
|        | 32.8  | 38.4  |       | 42.4  |       | 35.9  |       | 37.1  |       |
|        | 21.9  | 27.1  |       | 31.2  |       | 24.6  |       | 26.1  |       |
|        | 26.0  | 31.3  |       | 35.7  |       | 28.9  |       | 30.1  |       |
|        | 99.3  | 120.7 |       | 137.2 |       | 110.5 |       | 115.8 |       |
| 26.50  | 24.82 | 33.85 | 30.18 | 39.12 | 34.30 | 31.72 | 27.62 | 32.72 | 28.95 |
|        | +1.68 |       | +3.67 |       | 4.82  |       | 4.10  |       | 3.57  |
|        |       |       |       |       |       |       |       |       |       |
| 28.8   | 22.9  | 17.0  |       | 23.0  |       | 15.7  |       | 16.5  |       |
| 42.6   | 35.6  | 30.8  |       | 35.9  |       | 29.0  |       | 30.3  |       |
| 31.8   | 33.9  | 29.1  |       | 34.1  |       | 26.6  |       | 28.5  |       |
| 36.2   | 35.8  | 30.9  |       | 36.4  |       | 29.2  |       | 30.3  |       |
| 139.4  | 12.82 | 107.8 |       | 129.4 |       | 100.5 |       | 105.6 |       |
| 34.85  | 32.05 | 30.18 | 26.95 | 34.30 | 32.35 | 27.62 | 25.12 | 28.1  | 26.40 |
|        | 2.80  |       | 32.3  |       | +2.37 |       | +3.50 |       | 2.55  |
|        |       |       |       |       | 3.98  |       |       |       |       |

26 continued Aug 16

333 26.2

47.1 47.8

44.4 43.3

47.1 41.0

1719 1583

4295 3958

+ 3.37

~~25.2~~

2 252

45.1

37.1

32.1

1901

39.58 3502

+ 4.56

24.8

39.2

280

32.3

1243

3502 3108

+ 3.94

180

31.3

296

31.9

1108

3108 2770

+ 3.38

+ 4.30 3.72 2.95 3.24 3.80 3.37 + 3.56 + 2.3

+ 4.10 4.55 4.88 3.86 4.13 4.16 + 4.35 - 5.7

+ 2.68 3.67 4.82 4.10 3.77 3.54 + 3.83 + 0.5

+ 3.80 3.23 ~~2.27~~ 3.50 2.55 3.38 + 3.40 + 3.8

+ 3.78



Aug 17

|      |                 |      |       |      |       |
|------|-----------------|------|-------|------|-------|
| 33.0 | 25.2            | 33.4 | 25.9  | 31.0 | 24.4  |
| 46.6 | 46.8            | 46.9 | 47.2  | 44.3 | 46.0  |
| 44.4 | 42.6            | 44.5 | 43.3  | 42.2 | 42.1  |
| 46.8 | 40.6            | 47.0 | 41.0  | 44.2 | 39.1  |
| 1708 | 1546            | 1718 | 1574  | 1617 | 1516  |
| 4270 | 3865            | 4295 | 3935  | 4042 | 3890  |
|      | +4.05           |      | +3.60 |      | +2.52 |
| 3    | 25.1            |      | 25.2  |      | 25.0  |
|      | 45.5            |      | 45.7  |      | 45.1  |
|      | 35.3            |      | 36.9  |      | 36.2  |
|      | 30.6            |      | 32.1  |      | 31.9  |
|      | 1345            |      | 1399  |      | 1382  |
| 3865 | 3405            | 3935 | 3498  | 3790 | 3455  |
|      | <del>5.00</del> |      | 4.37  |      | +3.35 |
|      | 4.65            |      |       |      |       |
|      | 23.2            |      | 24.3  |      | 25.2  |
|      | 38.2            |      | 39.1  |      | 39.8  |
|      | 27.2            |      | 28.0  |      | 29.0  |
|      | 31.2            |      | 31.8  |      | 33.1  |
|      | 1198            |      | 1232  |      | 1271  |
| 3404 | 2995            | 3498 | 3080  | 3455 | 3178  |
|      | <del>2.00</del> |      | 4.18  |      | +2.77 |
|      | 4.06            |      |       |      |       |
|      | 171             |      | 18.0  |      | 19.0  |
|      | 30.7            |      | 31.8  |      | 32.2  |
|      | 28.7            |      | 29.5  |      | 30.1  |
|      | 31.0            |      | 31.8  |      | 32.4  |
|      | 1075            |      | 1111  |      | 1137  |
| 2995 | 26.88           | 3080 | 27.75 | 3178 | 28.42 |
|      | 3.07            |      | 3.02  |      | 3.36  |

Position same as on page 22

Observations repeated, since  
only 5 were made. The first set (unreliable)  
on account of the circle not being  
clamped tight.



|      |       |       |      |      |       |      |       |       |       |
|------|-------|-------|------|------|-------|------|-------|-------|-------|
| 0 90 |       |       |      |      |       |      |       |       |       |
| 140  | 72    | 258   | 25.9 | 322  | 32.3  | 347  | 341   |       |       |
| 272  | 289   | 391   | 47.1 | 461  | 54.1  | 484  | 563   |       |       |
| 250  | 250   | 370   | 43.2 | 437  | 50.0  | 465  | 52.0  |       |       |
| 272  | 221   | 392   | 41.0 | 466  | 46.9  | 480  | 493   |       |       |
| 834  | 832   | 1411  | 1572 | 1686 | 1833  | 1716 | 1917  |       |       |
| 2085 | 2.080 | 3528  | 3930 | 4215 | 4582  | 4440 | 4792  | mean  |       |
|      | +0.05 | -4.02 |      |      | -3.37 |      | -3.52 | -3.64 | -29   |
| 90   | 180   |       |      |      |       |      |       |       |       |
| 67   | 33.8  |       |      | 392  |       | 41.4 |       |       |       |
| 263  | 540   |       |      | 595  |       | 1.8  |       |       |       |
| 180  | 454   |       |      | 51.3 |       | 52.9 |       |       |       |
| 130  | 41.2  |       |      | 46.4 |       | 48.2 |       |       |       |
| 64   | 1744  |       |      | 1964 |       | 2043 |       |       |       |
| 1612 | 4860  |       |      | 4582 | 4910  | 4792 | 5108  |       |       |
| 3930 | -4.30 |       |      |      | -3.28 |      | -3.16 | -3.58 | -77   |
| 430  |       |       |      | 472  |       | 497  |       |       |       |
| 57.3 |       |       |      | 2.1  |       | 4.3  |       |       |       |
| 468  |       |       |      | 51.3 |       | 53.6 |       |       |       |
| 57.0 |       |       |      | 55.5 |       | 58.0 |       |       |       |
| 1981 |       |       |      | 2161 |       | 2256 |       |       |       |
| 4360 | 4952  |       |      | 4910 | 5402  | 5108 | 5640  | 5.42  | +1.07 |
|      | -5.92 |       |      |      | -4.92 |      | -5.42 |       |       |
| 440  |       |       |      | 491  |       | 514  |       |       |       |
| 57.5 |       |       |      | 3.0  |       | 6.0  |       |       |       |
| 55.9 |       |       |      | 0.6  |       | 8.1  |       |       |       |
| 58.3 |       |       |      | 2.9  |       | 6.5  |       |       |       |
| 2187 |       |       |      | 2356 |       | 2480 |       |       |       |
| 4952 | 5392  |       |      | 402  | 5880  | 5640 | 6138  |       |       |
|      | -4.40 |       |      |      | 4.88  |      | 4.93  | -4.74 | -39   |

Review of  $B^0$  corrections to  $15^\circ$  apocres  
from  $0^\circ$  to  $90^\circ$  and from  $270^\circ$  to  $360^\circ$  determined for  
comparisons with  $15^\circ$  metal arc.

From observations recorded in Aug  
new from Zenith South.

| Date        | $0^\circ$ to $90^\circ$ |                     |                     |                     |                     |                     |
|-------------|-------------------------|---------------------|---------------------|---------------------|---------------------|---------------------|
|             | $0^\circ-15^\circ$      | $15^\circ-30^\circ$ | $30^\circ-45^\circ$ | $45^\circ-60^\circ$ | $60^\circ-75^\circ$ | $75^\circ-90^\circ$ |
| 1881 Jul 28 | +1.14                   | -0.65               | +1.00               | +0.40               | -0.57               | -1.18               |
| Jul 29      | +0.81                   | -0.57               | +1.57               | +0.29               | -0.89               | -1.17               |
| Aug 15      | +0.58                   | -0.39               | +0.33               | +0.18               | +0.52               | -1.19               |
| 15          | +0.87                   | -0.28               | +0.10               | +0.17               | -0.05               | -0.81               |
| 16          | +0.92                   | -0.39               | +0.35               | +0.18               | -0.02               | -1.00               |
| 16          | +0.57                   | +0.05               | +0.39               | +0.29               | -0.21               | -1.11               |
| 17          | +0.70                   | +0.18               | +0.20               | +0.06               | -0.35               | -0.79               |
| 18          | +1.15                   | -0.21               | -0.42               | -0.11               | +0.84               | -1.25               |
| Aug 7       | +0.87                   | -0.15               | +0.42               | +0.17               | +0.22               | -1.64               |
| 8           | +0.70                   | -0.47               | +0.48               | +0.17               | -0.09               | -0.80               |
| 9           | +0.92                   | +0.14               | +0.21               | +0.17               | +0.08               | -1.52               |
| 10          | +0.00                   | -0.54               | +0.43               | +0.65               | +0.52               | -1.04               |
| 11          | +0.775                  | -0.27               | +0.42               | +0.22               | +0.00               | -1.11               |
|             |                         |                     |                     |                     |                     | +1.41               |
|             |                         |                     |                     |                     |                     | -1.38               |

2  
+0.77 +0.77  
-0.27 +0.50  
+0.42 +0.92  
+0.22 +0.14  
+0.00 +0.14  
-1.11 -0.00



From  $240^\circ$  to  $360^\circ$ 

| Date                     | 270-285                         | 285-300                         | 300-315                         | 315-330                         | 330-345                          | 345-360                          |              |
|--------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|----------------------------------|----------------------------------|--------------|
| 18 <sup>th</sup> July 28 | +10 <sup>1</sup> / <sub>2</sub> | -43 <sup>1</sup> / <sub>2</sub> | +77 <sup>1</sup> / <sub>2</sub> | -92 <sup>1</sup> / <sub>2</sub> | +106 <sup>1</sup> / <sub>2</sub> | -157 <sup>1</sup> / <sub>2</sub> |              |
| July 28                  | +1.19                           | -.34                            | +93                             | -.75                            | +21                              | -1.25                            |              |
| May 8                    | +48                             | +10                             | +24                             | +33                             | +13                              | -1.29                            |              |
| " 9                      | +76                             | -.22                            | +1.16                           | -.30                            | +12                              | -1.52                            |              |
| " 9                      | +1.67                           | -53                             | +60                             | -.47                            | +100                             | -1.22                            |              |
| " 10                     | +65                             | -65                             | +1.02                           | +02                             | +19                              | -1.17                            |              |
| " 11                     | +56                             | -.37                            | +48                             | -.23                            | +49                              | -.93                             |              |
| " 11                     | +36                             | -.52                            | +24                             | +29                             | +46                              | -.82                             |              |
| " 14                     | +85                             | -.52                            | +45                             | +55                             | +18                              | -1.50                            |              |
| " 18                     | +63                             | +20                             | +34                             | +14                             | +11                              | -1.42                            |              |
| Aug. 7                   | +89                             | -.38                            | +52                             | -.09                            | +19                              | -1.21                            |              |
| " 8                      | +86                             | -.24                            | +60                             | -.16                            | +34                              | -1.38                            |              |
| " 9                      | +88                             | -.09                            | +86                             | -.08                            | -.05                             | -1.51                            |              |
| " 10                     | +64                             | -.42                            | +42                             | -.18                            | +51                              | -1.01                            |              |
|                          | +0.95                           | -0.37                           | +0.72                           | -0.15                           | +0.32                            | -1.48                            | +199<br>-200 |

+.95 +.95  
 -.27 +.58  
 +.72 +1.30  
 -.15 +1.15  
 +.35 +1.47  
 -1.48 +0.00





















1881phase,proj,1761R