UNIVERSITY OF CALIFORNIA PUBLICATIONS

ASTRONOMY

LICK OBSERVATORY BULLETIN

NUMBER 210

PRELIMINARY NOTE ON THE ORBIT OF MINOR PLANET 1911 M.T.

The first and third of the observations given below were published in *A. N.* No. 4528-29 and were also received at the Students' Observatory by telegraph at the time of discovery. Having unfortunately overlooked, until after the completion of our orbit computation, the second observation, which was published in *A. N.* No. 4530, we did not become aware of the

existence of additional observations until the receipt in January of *A. N.* No. 4545, containing Ebell's report on his orbit computation. Professor Leuschner then wrote to Professor Palisa for all the observational material. In response Professor Palisa recently furnished the following revised positions:

	Date, 1911	Local M.T.	App. α	App. δ	Observer
(1)	Oct. 3	14 ^h 51 ^m 56 ^s .0	0 ^h 42 ^m 04 ^s .83	+ 0° 15' 40".8	Palisa, Vienna
(2)	Oct. 4	10 49 41.3	0 43 43.30	— 0 12 48.9	Palisa, Vienna
(3)	Oct. 4	14 11 03.0	0 43 58.99	— 0 17 50.8	Pechule, Copenhagen
(4)	Oct. 4	15 07 05.0	0 44 03.14	— 0 19 12.5	Pechule, Copenhagen

The application of Leuschner's method, including the complete elimination of the parallax,¹ to the first,

second, and fourth of these observations, yielded the following two orbits as a result of the direct solution:

ELEMENTS I

$$\begin{aligned}
 T &= 1911, \text{ Aug. } 25.0876, \text{ G.M.T.} \\
 \omega &= 146^\circ 59' 10'' \\
 \Omega &= 185 \ 29 \ 48 \\
 i &= 8 \ 15 \ 24 \\
 e &= 0.434982 \\
 \mu &= 1259''.08 \\
 a &= 1.99512 \\
 \text{Period} &= 2.818 \text{ years.}
 \end{aligned}
 \left. \begin{array}{l} \\ \\ \\ \end{array} \right\} 1911.0$$

CONSTANTS FOR THE EQUATOR 1911.0

$$\begin{aligned}
 x &= r [9.999953] \sin (62^\circ 25' 04'' + v) \\
 y &= r [9.985680] \sin (332 \ 11 \ 49 + v) \\
 z &= r [9.403207] \sin (335 \ 39 \ 01 + v)
 \end{aligned}$$

O—C	1	3	4
$\cos \delta \Delta \alpha$	—2".1	(+0".6)	+0".6
$\Delta \delta$	+1.4	(+5.6)	+2.6

ELEMENTS II

$$\begin{aligned}
 T &= 1911, \text{ Sept. } 5.3759, \text{ G.M.T.} \\
 \omega &= 159^\circ 3' 32'' \\
 \Omega &= 185 \ 19 \ 0 \\
 i &= 8 \ 16 \ 41 \\
 e &= 0.365273 \\
 \mu &= 1428''.23 \\
 a &= 1.83431 \\
 \text{Period} &= 2.484 \text{ years.}
 \end{aligned}
 \left. \begin{array}{l} \\ \\ \\ \end{array} \right\} 1911.0$$

CONSTANTS FOR THE EQUATOR 1911.0

$$\begin{aligned}
 x &= r [9.999962] \sin (74^\circ 19' 13'' + v) \\
 y &= r [9.984521] \sin (344 \ 06 \ 45 + v) \\
 z &= r [9.419355] \sin (347 \ 07 \ 48 + v)
 \end{aligned}$$

O—C	1	3	4
$\cos \delta \Delta \alpha$	— 5".8	(+1".8)	+1".0
$\Delta \delta$	+11.8	(+5.7)	+2.4

¹ Klinkerfues, *Theoretische Astronomie*, Dritte Ausgabe von H. Buchholz, 82. Vorlesung; cf. also Anhang, Fünftes Beispiel, pages 1037 to 1045.

It is interesting to note that without elimination of the parallax the solution of the orbit would not have been possible.

The residuals of the third observation, which was not used in the orbit computation, are given with those of the first and fourth observations on which the solutions were based. In the nature of the solution the second observation is, of course, accurately represented. The residuals of the first orbit are entirely satisfactory except that the declination residuals are all of the same sign. The declination residual of the first observation for the second orbit is too large in comparison with the probable error of observation. As the preliminary analysis of the conditions of the problem indicated that this residual could not be accounted for by the neglected third differences of the motion, the second solution might have been discarded and a search ephemeris computed merely from the first orbit. In order to further test the reality of the second solution and to possibly improve the orbits by the removal of the residuals an independent differential correction of both orbits was undertaken. Both orbits then converged to the same result within the accuracy of the solution. In this differential correction the mean of the residuals of the third and fourth observations was adopted as the residual for the fourth observation.

The residuals after the separate differential correction of the two orbits are as follows:

I				
O-C	1	$\frac{1}{2}(3+4)$	3	4
$\cos \delta \Delta \alpha$	+4".1	-0".2	(-0".3)	(-0".1)
$\Delta \delta$	+1.5	+0.2	(+2.3)	(-1.9)

II				
O-C	1	$\frac{1}{2}(3+4)$	3	4
$\cos \delta \Delta \alpha$	+4".1	+0".6	(+0".8)	(+0".4)
$\Delta \delta$	+1.3	+0.4	(+2.3)	(-1.4)

The first set of residuals corresponds to the following adopted elements:

ADOPTED ELEMENTS

$$\begin{aligned}
 T &= 1911, \text{ Aug. } 20.7480, \text{ G.M.T.} \\
 \omega &= 141^\circ 20' 27'' \\
 \Omega &= 185 \quad 35 \quad 59 \\
 i &= 9 \quad 31 \quad 23 \quad \left. \vphantom{\begin{matrix} \Omega \\ i \end{matrix}} \right\} 1911.0 \\
 e &= 0.509369 \\
 \mu &= 1050''.06 \\
 a &= 2.25179 \\
 \text{Period} &= 3.379 \text{ years.}
 \end{aligned}$$

CONSTANTS FOR THE EQUATOR 1911.0

$$\begin{aligned}
 x &= r [9.999944] \sin (56^\circ 51' 51'' + v) \\
 y &= r [9.986960] \sin (326 \quad 38 \quad 2 + v) \\
 z &= r [9.383749] \sin (330 \quad 34 \quad 35 + v)
 \end{aligned}$$

The foregoing residuals indicate that there is a relative error of observation of from 3 to 4 seconds in the declinations of the third and fourth places; that the difference between the elements (I) of the direct solution and the adopted elements approximately represents the uncertainty of the solution; that the observations do not admit of an exact representation owing to errors of observation, provided the perturbations due to the Earth be considered negligible.

From the adopted elements we have computed the following ephemeris for 1911.0:

EPHEMERIS FOR GREENWICH MEAN MIDNIGHT					
1911	α	δ	Δ	Mag.	
Sept. 1.5	22h 15m.8	+31° 03'	0.1318	10.7	
9.5	23 11.1	22 45	0.1359		
17.5	23 53.2	13 44	0.1515	11.1	
Sept. 25.5	0 22.4	6 00	0.1779		
Oct. 3.5	42.0	+ 0 19	0.2140	12.0	
11.5	0 55.2	- 3 29	0.2585		
19.5	1 4.6	5 47	0.3112	12.9	
Oct. 27.5	12.0	6 56	0.3718		
Nov. 4.5	18.7	7 15	0.4403	13.8	
12.5	25.2	6 58	0.5167		
Nov. 20.5	1 32.0	- 6 15	0.6010	14.6	

The ephemeris was computed for about a month before discovery in the hope that the object may be found on plates taken previous to the discovery. An ephemeris corresponding to the first direct solution would require the following corrections to the adopted ephemeris:

Sept. 1.5	+27m.5	-4° 41'
Oct. 3.5	00.0	0 00
Nov. 20.5	+03.2	-0 23

Since the difference between the ephemerides on November 20 is only 3m.2 and 23' it should not be difficult to locate the object on any plates that may be available for this purpose.

Observers are requested to search available plates without delay and to notify the Students' Observatory by telegraph in case the object be found and to forward their detailed photographic positions by mail. If no telegram is received at the Students' Observatory announcing the finding of the object before June 1, another solution of the orbit will be undertaken by including the attraction of the earth in the direct solution.

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BERKELEY ASTRONOMICAL DEPARTMENT,
April 20, 1912.