No. 154 THE ORBIT OF COMET NEWMAN 1932f-1932VII

by G. VAN BIESBROECK

ABSTRACT

Using 82 observations covering an interval of 213 days, a definitive orbit is obtained, taking planetary perturbations into account. The orbit comes out very nearly parabolic.

This faint comet was discovered by K. A. Newman on a plate taken at the Lowell Observatory, Flagstaff, on June 20, 1932. It appeared as a 12.5 mag. centrally condensed, diffuse coma of about 40″ in diameter, moving slowly in a northwesterly direction. Being conveniently located it was immediately taken under observation at many observatories. Newman found the comet also on two prediscovery Lowell plates, taken June 1 and 7, and this enabled F. L. Whipple and L. E. Cunningham (1932) immediately to compute an orbit showing that perihelion was due on September 24. Since the June 1 and June 7, 1932, positions were based on contact positives (HAC 249, 1932), I inquired at Lowell Observatory if I could measure the comet on the original negatives. Unfortunately, the originals could not be located, according to Henry L. Giclas. Most observers described the comet as a round coma, but H. M. Jeffers (1932) noticed, on a 20-minute exposure taken July 6 with the Crossley reflector, that there was a faint fan-shaped tail extending towards the southeast. With the 24-inch reflector at Yerkes Observatory I recorded a tail 2′ long in position angle 160° on July 8, and on August 6 the length was estimated as 3′ in the direction 150°. The brightness changed very little during the first two months of visibility, but the comet began to fade in October so that observations became scarce. I recorded Comet Newman for the last time on January 20, 1933, when the total brightness was reduced to 15 mag. After that the comet was lost in the evening twilight. The measures cover an interval of 213 days.

Preliminary orbits were deduced by Whipple and Cunningham, as well as by M. Davidson (1932). A more accurate parabola was computed by A. S. Schmitt (1933), who used observations from June 21 to July 22. He noticed a slight systematic run in the residuals, however, pointing to an eccentricity $e = 0.999838$. I have used his parabolic orbit as a basis for the differential correction:

$$\left.\begin{aligned} \omega &= 69^\circ 48' 20''.4 \\ \Omega &= 245\ 08\ 22.6 \\ i &= 78\ 23\ \ 0.9 \end{aligned}\right\} \quad 1932.0$$

$$q = 1.647061 \text{ AU}$$

$$T = 1932 \text{ Sept } 24.55930 \text{ UT}$$

Table I gives the residuals from the 82 measures between June 21, 1932, and Jan 20, 1933, that were kept after we discarded a few that showed abnormal deviations. The positions were re-reduced with improved values for the coordinates of the comparison stars.

TABLE I

Residuals, O - C

UT	Δα	Δδ	Obs.	UT	Δα	Δδ	Obs.	UT	Δα	Δδ	Obs.
1932	s	″		1932	s	″		1932	s	″	
June 21.811	+0.47	+3.5	A	July 19.809	+0.63	+2.5	A	Oct 20.018	-2.70	+0.6	Kr
21.850	+0.16	+2.2	Sm	19.849	-0.09	-0.3	Sm	20.744	-1.84	-6.3	V
22.138	+0.60	+1.2	V	20.845	-0.22	-0.1	Sm	21.750	-2.80	-4.5	Kr
22.816	+0.23	+3.2	A	22.612	+0.44	-1.6	V	24.715	-2.30	-6.4	A
22.941	-0.02	0.0	St	23.127	-0.17	+0.9	V	Oct 27.030	-2.27	-6.7	V
23.200	-0.28	+1.7	V	23.142	-0.15	+2.1	V				
23.764	-0.09	+3.8	A	23.849	+0.17	-6.6	A	Nov 17.015	-2.53	-8.2	V
23.856	-0.24	-3.4	Sm	25.140	+0.27	-2.5	V	19.026	-2.40	-6.0	V
23.941	-0.23	-0.7	St	25.812	+0.13	-3.0	A	Nov 26.096	-2.94	-9.3	V
24.205	-0.33	-0.2	V	26.813	+0.37	-1.0	A				
24.867	-0.14	0.0	Sm	27.831	+0.30	-2.0	A	Dec 14.980	-3.40	-11.3	V
25.851	+0.64	+4.1	A	27.934	+0.24	-2.4	M				
June 25.859	-0.10	+2.3	Sm	30.174	+0.16	-1.6	V	1933			
				30.187	+0.13	-1.8	V	Jan 20.075	-3.24	-9.2	V
June 28.126	+0.16	-0.5	V	30.494	+0.37	-1.3	A				
28.839	+0.04	+1.6	A	July 30.930	-0.06	-5.6	M				
29.969	-0.07	-1.0	Sm								
June 30.175	-0.03	+1.7	V	Aug 3.837	+0.14	-2.0	A				
July 1.947	+0.05	+2.6	Sm	4.886	+0.06	+2.2	Sm				
3.132	-0.08	+2.1	V	5.843	+0.08	-4.3	Sm				
3.850	-0.30	+1.4	A	5.872	-0.13	-4.1	M				
3.922	+0.76	-0.6	M	6.187	+0.37	-3.0	V				
4.304	+0.87	-1.4	J	6.872	-0.09	-1.5	A				
4.519	+0.54	+0.1	K	8.971	-0.02	-0.1	M				
4.568	+0.79	-3.9	K	Aug 9.887	+0.31	-1.8	M				
4.847	+0.57	-1.9	Sm								
4.941	-0.51	-3.5	St	Aug 20.807	+0.86	-1.8	A				
July 4.957	-0.29	-3.5	M	22.851	+0.15	-0.5	M				
				23.880	+0.53	-1.8	M				
July 5.148	+0.21	-2.7	V	25.869	0.0	-0.9	M				
5.286	+0.39	-2.7	J	Aug 27.842	+0.42	-0.9	A				
5.907	+0.19	-3.3	M	Sept 2.752	+0.17	-3.5	A				
5.942	+0.18	-3.3	Kr								
6.375	+0.10	-4.0	J	Sept 19.785	-1.08	-3.9	A				
6.338	+0.16	-1.6	J	20.083	-0.58	-3.4	V				
6.925	+0.66	-4.4	D	21.743	-0.37	-3.3	A				
7.219	+0.66	-5.1	J	22.653	-0.30	-4.2	V				
7.232	+0.77	-3.5	J	23.808	-0.17	-4.2	A				
7.922	+0.35	-2.4	D	Sept 29.054	-0.34	-0.6	V				
8.177	+0.23	-1.8	V	Oct 1.806	-2.00	-3.3	Kr				
9.727	-0.05	-6.2	M	5.755	-2.74	-4.7	A				
10.878	-0.52	-5.3	Sm								
12.939	+0.03	-2.8	A								
July 13.962	-0.07	-3.5	A								

Observers

- A Adamopoulos - Athens
- D Delporte - Uccle
- J Jeffers - Lick
- K Kubokawa - Tokyo
- Kr Krumpholz - Vienna
- M Mündler - Heidelberg
- Sm Schmitt - Alger
- St Struve - Babelsberg
- V Van Biesbroeck - Yerkes

The residuals were grouped in 11 normal places as shown in Table II. The equations of condition were computed in the form given by G. Stracke (1929). For that purpose the ecliptic elements were transformed into equatorial ones:

$$\left.\begin{aligned} \omega' &= 217^\circ 08' 56''.7 \\ \Omega' &= 251\ 28\ 58.3 \\ i' &= 69\ 35\ 55.5 \end{aligned}\right\} \quad 1932.0$$

Perturbations by all planets except Mercury and Pluto were computed at 20-day intervals taking Sept. 30, 1932, as the date of osculation. The interpolated values are indicated in Table II, where the residuals to be corrected are listed. The solution was made on

TABLE II

Normal Places

UT	Residuals, O-C		Weight	Perturbations		To be Corrected		Final Residuals	
	Δαcosδ	Δδ		Δαcosδ	Δδ	Δαcosδ	Δδ	Δαcosδ	Δδ
1932 Jun 23.7	+ 0″.7	- 1″.1	13	-1″.7	-0″.5	+ 2″.4	- 0″.6	-2″.0	-1″.8
Jul 2.7	+ 1.9	- 0.1	14	-1.4	-0.4	+ 3.3	+ 0.3	-0.8	+0.4
Jul 7.9	+ 3.1	- 3.5	15	-1.2	-0.4	+ 4.4	- 3.1	+0.7	-2.4
Jul 27.0	+ 4.6	- 1.5	16	-0.5	-0.3	+ 6.1	- 1.2	+2.5	+2.1
Aug 6.5	+ 1.0	- 2.8	8	-0.3	-0.2	+ 1.3	- 2.6	-2.5	+2.8
Aug 26.1	+ 4.4	- 1.6	6	-0.1	-0.1	+ 4.5	- 1.5	+3.8	-0.8
Sep 24.6	-12.2	- 3.5	8	0.0	0.0	-12.2	- 3.5	+3.3	+2.0
Oct 22.5	-21.5	- 4.5	5	-0.1	0.0	-21.4	- 4.5	-1.8	-2.2
Nov 20.7	-26.9	- 7.8	3	-0.2	-0.2	-26.7	- 7.6	-1.9	+1.9
Dec 15.0	-26.1	-11.3	1	+0.2	+0.2	-26.3	-11.5	-0.1	-1.8
1933 Jan 20.1	-34.5	- 9.2	1	+0.1	+0.4	-34.6	- 9.6	-3.1	-1.9

the IBM-1130 computer of the Lunar and Planetary Laboratory with the result:

$$\left.\begin{aligned} \Delta\omega' &= -\ 1''.3 \pm 0''.6 \\ \Delta\Omega' &= -\ 9.5 \pm 0.2 \\ \Delta i' &= +10.1 \pm 0.2 \end{aligned}\right\} \quad \text{m.e}$$

$$\begin{aligned} \Delta e &= -0.0000193 \pm 0.0000012 \\ \Delta q &= +0.0000271 \pm 0.0000032 \text{ AU} \\ \Delta T &= +0.0000062 \pm 0.0000012 \text{ day} \end{aligned}$$

The corrected equatorial elements become:

$$\left.\begin{aligned} \omega' &= 217^\circ 08' 55''.4 \\ \Omega' &= 251\ 28\ 48.8 \\ i' &= 69\ 36\ 05.6 \end{aligned}\right\} \quad 1932.0$$

$$\begin{aligned} e &= 0.9999807 \\ q &= 1.647088 \text{ AU} \\ T &= 1932 \text{ Sept } 24.55931 \text{ UT} \end{aligned}$$

The corresponding final ecliptic elements become:

$$\left.\begin{aligned} \omega' &= 69^\circ 38' 08''.9 \\ \Omega' &= 245\ 23\ 24.6 \\ i' &= 78\ 23\ 10.6 \end{aligned}\right\} \quad 1950.0$$

$$\begin{aligned} e &= 0.9999807 \\ q &= 1.647088 \text{ AU} \\ T &= 1932 \text{ Sept } 24.55958 \text{ ET} \end{aligned}$$

Osculation date: Sept 30, 1932.

The reciprocal semi-major axis turns out to be 12 units of the 6th decimal. The original and future values of $1/a$ can readily be found by using the planetary perturbations given by E. Everhart and N. Raghavan (1970) for this comet. They are computed by taking the perihelion as time of osculation. Our elements are referred to a date six days later. That small difference should be entirely negligible. The values of original and future $1/a$ come out +0.000319 and +0.000048 so that the future orbit becomes even more elliptical than the osculating one, although the corresponding period is many thousands of years.

Acknowledgment. Support of this work by the National Science Foundation under Contract GP-17784 is hereby gratefully acknowledged.

REFERENCES

Davidson, M. 1932, *J. Brit. Astr. Assoc.*, **42**, 347–349.

Everhart, E., and Raghavan, N. 1970, *A. J.*, **75**, 258–272.

Jeffers, H. M. 1932, *Lick Obs. Bull.*, **16**, 49–52.

Schmitt, A. S. 1933, *J. Obs.*, **16**, 19–20.

Stracke, G. 1929, *Bahnbestimmung der Planeten und Kometen*, Berlin.

Whipple, F. L., and Cunningham, L. E. 1932, *Beob. Zirk.*, **23**.

Whipple, F. L. 1932, *H. A. C.*, 249.