UNIVERSITY OF CALIFORNIA PUBLICATIONS
ASTRONOMY

LICK OBSERVATORY BULLETIN

NUMBER 465

PLUTO—EPHEMERIS FOR 1934/35—SIXTH PAPER

BY

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As in previous years, the following ephemeris of *Pluto* is from Orbit XIX¹ and includes the separate action by the four major planets.

Comparisons with the ephemeris in *B.J.* 1935 from the same elements give:

	$\Delta\alpha$	$\Delta\delta$
Bower—B.J.	+1'0	+0'2

Probably that ephemeris does not include perturbations since the epoch of osculation.

The residuals of two positions by Jeffers² at Mount Hamilton during the opposition 1933/34 closely agree with those of preceding years:

G.C.T.	$\alpha(1900.0)$	$\delta(1900.0)$	$\Delta\alpha$	$\Delta\delta$
1934 Feb 12.2635	7 ^h 38 ^m 29 ^s .16	+22°54'1".4	-0'7	+0'4
12.2767	29.08	1.6	-1.0	+0.4

Positions of asteroids, comets, etc., are based on comparison stars from catalogs giving "mean" places. These are derived from observed apparent places under the assumption that the Earth's orbit is a circle; that is, since the eccentricity term in the annual aberration has been neglected³, the catalog places may differ in α from

¹ *Lick Obs. Bull.* 15 174, 1931.

² *Lick Obs. Bull.* 17, 7, 1934.

³ Newcomb, *Compendium of Spherical Astronomy*, pp. 164, 167, 1906.

the actual mean places by $\pm 0''.34$ sec δ . Observational precision has so increased that the accuracy of a carefully reduced position or of a normal place is often comparable to this term. The time has arrived, therefore, when observers and orbit investigators may expect this term to be included, as it can be very simply, by the meridian observer in his reduction to mean place or by the fundamental catalog investigator as an additional systematic correction. Alternatively, the term must be applied individually to positions and normal places, or to ephemerides.

From Baade's recent determination of *Pluto*'s photographic magnitude and color index, 15.57 and +0.67, respectively, the visual magnitude 14.9⁴ is obtained. Hence the former conclusions regarding *Pluto*'s mass are confirmed,⁵ namely:

(1) Assuming nearly the lowest albedo and the greatest density known in the solar system, 0.07 and 5, respectively, *Pluto* < 0.2 Earth.

(2) Assuming that *Pluto* has the same albedo and density as *Triton*, and adopting the mass of *Triton* found by Nicholson, van Maanen, and Willis,⁶ *Pluto* < 0.1 Earth.

⁴ *Publ. A. S. P.*, 46, 218, 1934.

⁵ *Lick Obs. Bull.* 16, 115, 1933.

⁶ *Publ. A. S. P.* 43, 261, 1931.

ASTROGRAPHIC* EPHEMERIS 1934/35

G.C.T.	$\alpha(1900.0)$	a	b	$\delta(1900.0)$	a	b	ρ	Eccentricity term	
1934 Aug 20	116°54' 7".1	+448".4		+22°40' 37".5	-49".9		41.0769	-".35	+".06
25	117 1 35.5	427.0	-21".4	39 47.6	45.9	+4".0			
30	8 42.5	403.2	23.8	39 1.7	41.3	4.6			
Sept 4	15 25.7	376.8	26.4	38 20.4	36.2	5.1			
9	21 42.5	347.9	28.9	37 44.2	30.8	5.4			

* The observed astrographic position, corrected for parallax and the eccentricity term in the annual aberration (additive, as tabulated above), is to be compared with the ephemeris position interpolated with the observed time.

ASTROGRAPHIC* EPHEMERIS 1934/35—(Concluded)

ASTROGRAPHIC* EPHEMERIS 1934/35—(Concluded)										Eccentricity term	
G.C.T.			$\alpha(1900.0)$	a	b	$\delta(1900.0)$	α	b	p		
1934	Sept	14	117°27'30".4	+316".9	-31".0	+22°37'13".4	-24".9	+5".9	40.7687	-.35	+.06
		19	32 47.3	283.9	33.0	36 48.5	18.7	6.2			
		24	37 31.2	249.4	34.5	36 29.8	12.4	6.3			
		29	41 40.6	213.3	36.1	36 17.4	-5.6	6.8			
		Oct 4	45 13.9	175.5	37.8	36 11.8	+1.3	6.9			
		9	117 48 9.4	+136.4	-39.1	+22 36 13.1	+8.4	+7.1	40.3591	-.35	+.06
		14	50 25.8	96.6	39.8	36 21.5	15.6	7.2			
		19	52 2.4	56.3	40.3	36 37.1	22.8	7.2			
		24	52 58.7	+15.9	40.4	36 59.9	29.9	7.1			
		29	53 14.6	-24.9	40.8	37 29.8	37.0	7.1			
	Nov	3	117 52 49.7	-65.4	-40.5	+22 38 6.8	+44.0	+7.0	39.9156	-.35	+.06
		8	51 44.3	105.3	39.9	38 50.8	50.8	6.8			
		13	49 59.0	144.0	38.7	39 41.6	57.1	6.3			
		18	47 35.0	181.4	37.4	40 38.7	63.1	6.0			
		23	44 33.6	216.9	35.5	41 41.8	68.7	5.6			
	Dec	28	117 40 56.7	-250.9	-34.0	+22 42 50.5	+73.9	+5.2	39.5166	-.35	+.06
		3	36 45.8	282.5	31.6	44 4.4	78.4	4.5			
		8	32 3.3	311.3	28.8	45 22.8	82.5	4.1			
		13	26 52.0	337.1	25.8	46 45.3	85.8	3.3			
		18	21 14.9	359.5	22.4	48 11.1	88.4	2.6			
		23	117 15 15.4	-378.8	-19.3	+22 49 39.5	+90.3	+1.9	39.2370	-.35	+.06
		28	8 56.6	394.5	15.7	51 9.8	91.7	1.4			
1935 Jan		2	2 22.1	406.3	11.8	52 41.5	92.2	+0.5			
		7	116 55 35.8	414.1	7.8	54 13.7	92.0	-0.2			
		12	48 41.7	417.6	-3.5	55 45.7	91.0	1.0			
	17	116 41 44.1	-417.2	+0.4	+22 57 16.7	+89.4	-1.6	39.1302	-.36	+.06	
	22	34 46.9	412.9	4.3	58 46.1	87.1	2.3				
Feb	27	27 54.0	404.8	8.1	+23 0 13.2	84.2	2.9				
	1	21 9.2	392.5	12.3	1 37.4	80.6	3.6				
	6	14 36.7	376.2	16.3	2 58.0	76.6	4.0				
	11	116 8 20.5	-356.4	+19.8	+23 4 14.6	+71.8	-4.8	39.2144	-.36	+.06	
	16	2 24.1	333.4	23.0	5 26.4	66.8	5.0				
	21	115 56 50.7	307.3	26.1	6 33.2	61.3	5.5				
	26	51 43.4	278.5	28.8	7 34.5	55.6	5.7				
	Mar 3	47 4.9	246.8	31.7	8 30.1	49.4	6.2				
	8	115 42 58.1	-212.6	+34.2	+23 9 19.5	+43.0	-6.4	39.4676	-.36	+.06	
	13	39 25.5	176.8	35.8	10 2.5	36.5	6.5				
	18	36 28.7	139.5	37.3	10 39.0	29.9	6.6				
	23	34 9.2	101.0	38.5	11 8.9	23.2	6.7				
	28	32 28.2	61.5	39.5	11 32.1	16.4	6.8				
	Apr	2	115 31 26.7	-21.1	+40.4	+23 11 48.5	+9.7	-6.7	39.8345	-.36	+.06
		7	31 5.6	+19.6	40.7	11 58.2	+3.0	6.7			
12		31 25.2	60.0	40.4	12 1.2	-3.6	6.6				
17		32 25.2	99.9	39.9	11 57.6	10.0	6.4				
22		34 5.1	139.3	39.4	11 47.6	16.1	6.1				
	27	115 36 24.4	+178.0	+38.7	+23 11 31.5	-22.2	-6.1	40.2412	-.36	+.06	
	May 2	39 22.4	215.6	37.6	11 9.3	28.1	5.9				
	7	42 58.0	252.0	36.4	10 41.2	33.5	5.4				
	12	47 10.0	286.3	34.3	10 7.7	38.8	5.3				
	17	51 56.3	318.9	32.6	9 28.9	43.6	4.8				
	22	115 57 15.2	+349.7	+30.8	+23 8 45.3	-48.2	-4.6	40.6116	-.36	+.06	
	27	116 3 4.9	378.6	28.9	7 57.1	52.4	4.2				
	June 1	9 23.5	405.2	26.6	7 4.7	56.3	3.9				
		6	16 8.7			6 8.4					

BERKELEY ASTRONOMICAL DEPARTMENT,
August 29, 1934.
Issued October 4, 1934.