JPL PUBLICATION 78-85

Comet Tempel 2

Orbit, Ephemerides and Error Analysis

D. K. Yeomans

(NASA-CR-157598) COMET TEMPEL 2: ORBIT, EPHEMERIDES AND ERROR ANALYSIS (Jet Propulsion Lab.) 35 p HC A03/MF A01 CSCL 03A
N78-32018
Unclas
G3/89 31538

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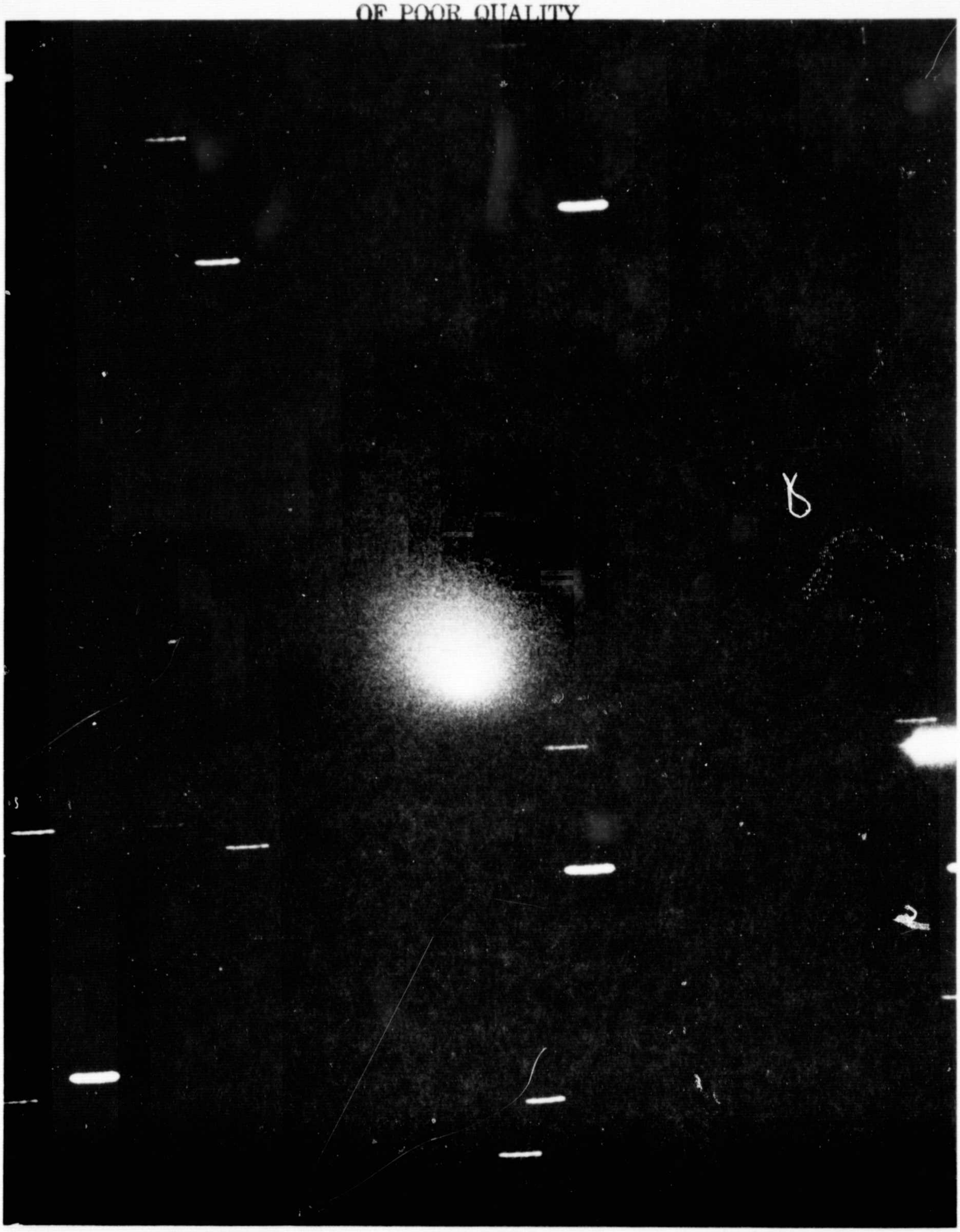
The research described in this publication was carried out by the Jet Propulsion Laboratory, California Institute of Technology, under NASA Contract No. NAS7-100.

Abstract

The dynamical behavior of comet Tempel 2 is investigated and the comet is found to be very well behaved and easily predictable. The nongravitational forces affecting the motion of this comet are the smallest of any comet that is affected by nongravitational forces. The sign and time history of these nongravitational forces imply (1) a direct rotation of the comet's nucleus and (2) the comet's ability to outgas has not changed substantially over its entire observational history. The well behaved dynamical motion of the comet, the well observed past apparitions, the small nongravitational forces and the excellent 1988 ground based observing conditions all contribute to relatively small position and velocity errors in 1988--the year of a proposed rendezvous space mission to this comet. To assist in planned ground based and earth orbital observations of this comet, ephemerides are given for the 1978-79, 1983-84 and 1988 apparitions.



PERIODIC COMET TEMPEL 2

Photographed by H. M. Jeffers at Lick Observatory
Fall 1946

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1. Introduction

On July 3, 1873 Ernst Wilhelm Liebrecht Tempel, a German astronomer working at Arcetri Observatory, Italy, discovered a comet in Cetus. Upon discovery, the comet was approximately 9.5 magnitude, 2 arc minutes in diameter, somewhat elongated in shape with an eccentric condensation of light and a granular appearance. Orbit computations quickly established that the comet was short periodic and Tempel himself was the first to recover the comet on its next return to perihelion in 1878. Tempel had previously discovered two other short-period comets--one in 1867 (Tempel 1) and the other in 1869 (Tempel-Swift). Hence his 1873 comet is denoted Tempel 2 to show this was the second comet to have been discovered by Tempel alone. Within the time of six years and three months, Tempel had discovered three periodic comets--a record that will likely stand for some time. Since its discovery in 1873, comet Tempel 2 has been observed during 16 of its 21 returns to perihelion. Since 1946, every apparition has been observed.

Comet Tempel 2 has recently become of interest as the prime target for a first space rendezvous mission to a comet. NASA's Comet Science Working Group has recommended a rendezvous mission to comet Tempel 2 in 1988 with an en route flyby of comet Halley in late 1985 (Belton, 1978). As the primary objective of the first mission to a comet, the dynamical behavior of comet Tempel 2 is of great interest.

For the majority of short-period comets with three or more apparitions, obvious nongravitational perturbations are affecting their motions. By assuming that these nongravitational accelerations are due to the rocket effect of outgassing volatiles from an icy-conglomerate nucleus (Whipple 1950), the nongravitational accelerations have been successfully modeled by Marsden et al. (1973). The mathematical form of these nongravitational terms represents an empirical fit to a theoretical plot of water-snow vaporization flux versus heliocentric distance. The cometary equations of motion are written

$$\frac{d^2\vec{r}}{dt^2} = -\mu\frac{\vec{r}}{r^3} + \frac{\partial R}{\partial \vec{r}} + A_1 g(r)\hat{r} + A_2 g(r)\hat{T},$$

where

$$g(r) = \alpha(r/r_o)^{-m}\left[1 + (r/r_o)^n\right]^{-k}.$$

The acceleration is given in astronomical units/(ephemeris day)^2, μ is the product of the gravitational constant and the solar mass, while R is the planetary disturbing function. The scale distance r_o is the heliocentric distance where reradiation of solar energy begins to dominate the use of this energy for vaporizing the comet's nuclear ices. For water ice r_o = 2.808 AU and the normalizing constant α = 0.111262. The exponents m, n, and k equal 2.15, 5.093, and 4.6142, respectively. The nongravitational acceleration is represented by a radial $[A_1 g(r)]$ and a transverse $[A_2 g(r)]$ term in the equations of motion. The radial unit vector ($\hat{r}$) is defined outward along the radius vector while the transverse unit vector ($\hat{T}$) is directed normal to $\hat{r}$, in the orbit plane and in the direction of the comet's motion. An acceleration component normal to the orbit plane has been found to have a negligible effect upon the orbital motion of short-period comets. The parameters A_1 and A_2, as well as the six initial conditions, can be solved for in the least-squares differential correction procedure.

Integrated variational orbits were used to form the necessary partial derivatives and the employed numerical integrator was a ninth-order predictor-corrector scheme (summed ordinate form) running at a constant one-day step size. At each step, the required planetary coordinates, from all nine planets, have been read from magnetic tape. All computations were performed in double precision (18 significant figures) on the UNIVAC 1108 computers at the Jet Propulsion Laboratory.

2. Orbit Computations

Without solving for nongravitational parameters, Marsden (1968) linked five apparitions of Tempel 2 (1946-1967) with a mean residual of 1.8 arc seconds. Marsden and Sekanina (1971), solving for the nongravitational parameters A_1 and A_2, managed to successfully link four different sets of apparitions from 1873 through 1967. These parameters, taken from Marsden, Sekanina and Yeomans (1973) are listed in Table 2.

The present orbital solutions are represented in Table 1. Orbit number 1 did not solve for the nongravitational parameters while orbits 2 and 3 solved for A_1 and A_2. In Table 1 the second column gives the observational interval included in the solution, the third and fourth columns present the number of observations employed and the mean of the absolute values of the residuals. Columns 5 and 6 give the radial (A_1) and transverse (A_2) nongravitational parameters.

From Tables 1 and 2, the transverse nongravitational parameters are seen to be small and nearly constant in time. Because the transverse nongravitational acceleration directly affects the comet's orbital energy, this component is more accurately determined. If one assumes that the comet's spin axis is not precessing, the magnitude of A_1 and A_2 over a period of time is a direct measure of a comet's ability to outgas. From Table 2, we note that, within the associated errors, A_1 and A_2 have remained nearly constant and the comet's ability to outgas has not changed substantially over its entire observational history. The magnitude of this comet's nongravitational parameters is the smallest of any comet that is affected by nongravitational forces. The very slight secular deceleration ($A_2 > 0$) implies that the comet's nucleus is rotating in a direct sense. The very small mean residual resulting from the 1956-1977 orbit (orbit #2, Table 1) implies that this comet is very well behaved and very easy to predict dynamically.

3. Ephemeris Computations

In order to generate accurate prediction ephemerides for the coming apparitions, orbit #2 of Table 1 was integrated forward taking into account nongravitational effects and perturbations from all planets. Ephemerides for the 1978-79, 1982-83 and 1988 apparitions are presented in Appendix A.

Sekanina, et al. (1978) have investigated the nuclear magnitude of comet Tempel 2 based upon Roemer's photographic observations in 1962, 1967 and 1972. They find the absolute nuclear magnitude to be 15.0 ± 0.5 pre-perihelion and 16.0 ± 0.3 post-perihelion. However the scatter is so large that an absolute nuclear magnitude of 15.5 was assumed for the present computations. For comet Tempel 2, the variation of total magnitude with heliocentric distance is quite asymmetric with respect to perihelion. This comet brightens very quickly about 80 days before perihelion and this dramatic increase in brightness before perihelion is followed by a less steep decline post-perihelion (see Figure 1). For prediction purposes, a Chebychev series was fit to the light curve of comet Tempel 2

(Figure 1) and total magnitude predictions were made by evaluating this series at appropriate times.

The osculating orbital elements, derived from orbit #2 of Table 1, are presented in Table 3 for the seven returns to perihelion 1957-1988.

4. Error Analysis

A statistical covariance error analysis was undertaken to determine the evolution of comet Tempel 2's error ellipsoid during the 1988 apparition. The ORAN computer program took into account planetary perturbations and considered the errors inherent in the values for the nongravitational parameters and initial conditions. The partial derivatives utilized in the conditional equations matrices and the state transition matrices were computed numerically.

For the present analysis, the four returns to perihelion (1972-1988) are represented by eight observations from September 22, 1973 through April 17, 1977 and by 26 additional postulated observations from April 6, 1983 through September 16, 1988. The 1983 and 1988 recoveries of the comet were conservatively assumed to be April 6, 1983 and March 20, 1988 respectively. The error analysis was initialized in 1973 and the initial a priori covariance matrix was essentially infinite. Each set of observations was batch processed and the updated covariance was propagated forward in time via the state transition matrix to the date of selected observations. The time history of the comet's position and velocity errors is presented in Table 4. The first column represents the dates in 1988 on which one simulated ground based observation was made. The columns headed by r, Δ and θ represent the sun-comet distance in AU, the earth-comet distance in AU and the sun-earth-comet angle in degrees. The next six columns represent the 1-σ position (km) and velocity (m/s) errors for the radial sun-comet direction (R), the direction normal to the comet's orbital plane (N), and the transverse direction defined by the cross product of the first two unit vectors (T = NXR). The present analysis assumed a 1-σ observational error of 2 arc seconds for both the right ascension and declination. The assumed error for each observation is the same value, and the observations themselves are assumed to be uncorrelated. This being the case, the covariance matrix is linear with respect to observational errors. For example, although the current analysis has been done using an observational error of 2 arc seconds, one only has to multiply the error component entries in Table 4 by 3/2 to obtain the results for σ=3 arc seconds.

From Table 4 we see that the transverse position error (σ_T) reaches a minimum in May when the conditions are excellent for observing the comet's along track error (see Figure 2). The radial position error reaches a minimum at perihelion (September 16) and this is due in part to the comet's radial velocity which reaches a minimum there. The comet's transverse velocity reaches a maximum at perihelion and this partially explains the growth of the transverse position error from May to September. For the present analysis, observations were assumed made every ten days in 1988 from March 20 to September 16. In Table 4, the improvement realized by making the 1988 observations at five day intervals is shown in parentheses for September 16.

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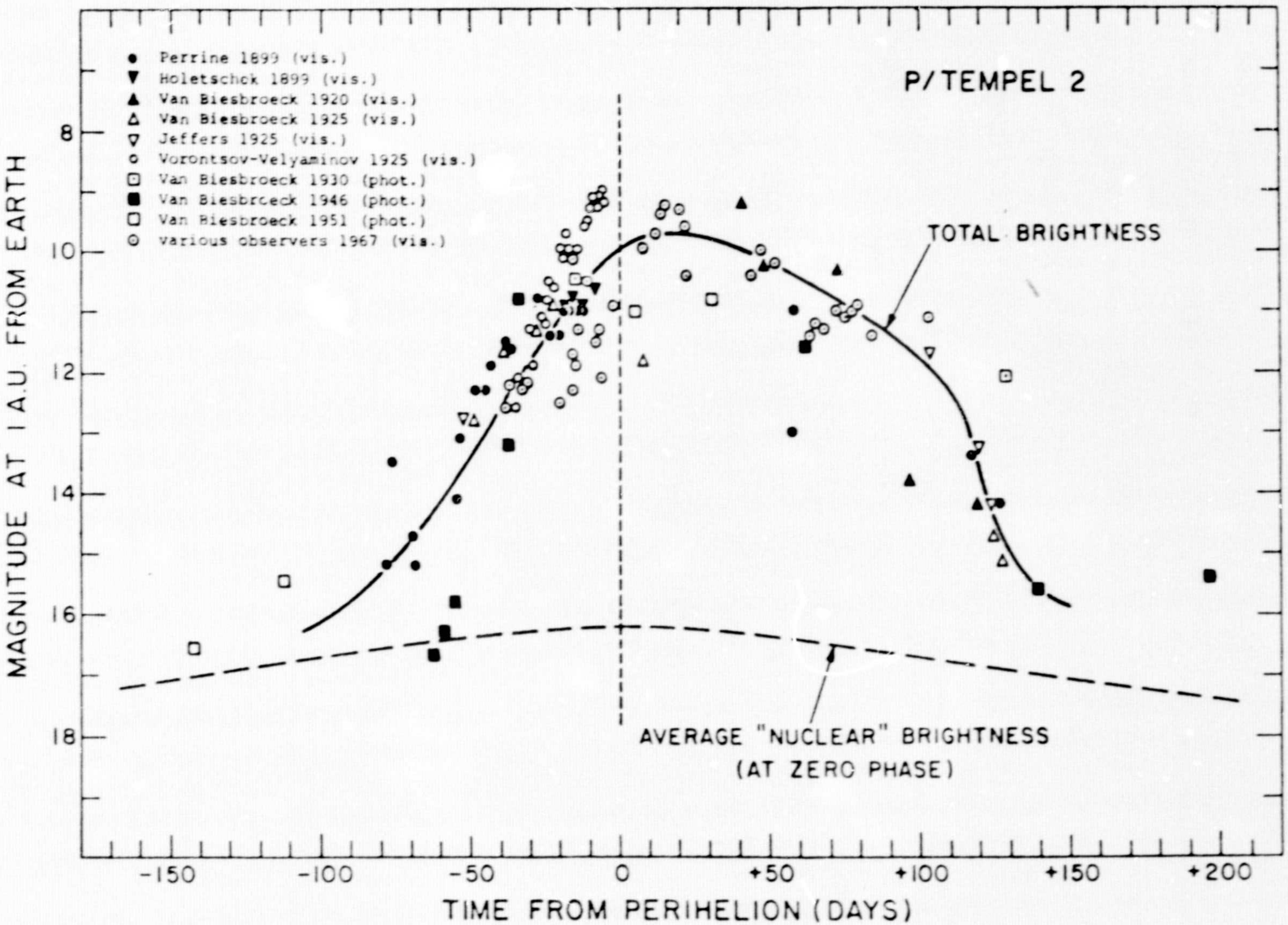
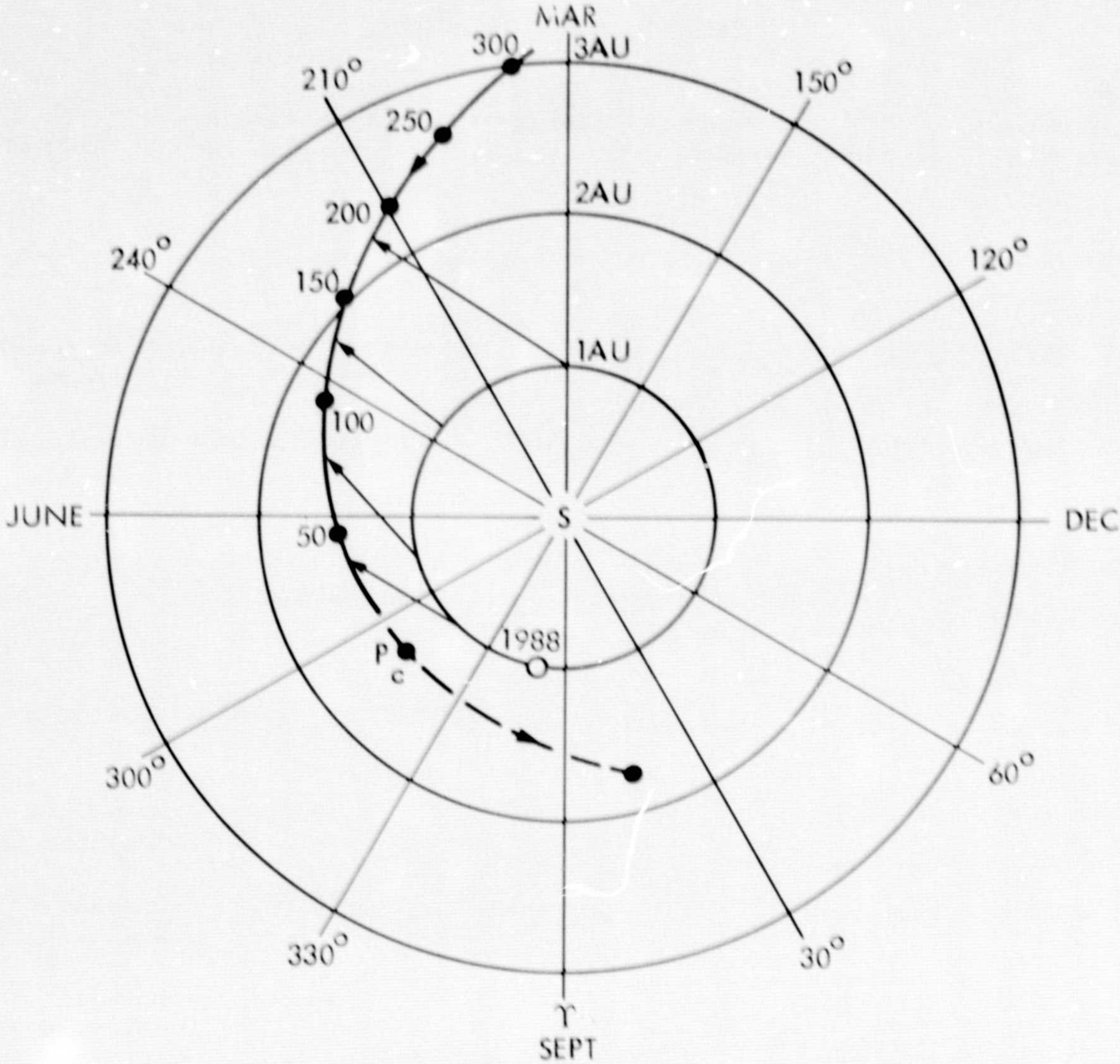


Figure 1. Light Curve for Comet Tempel 2



P c = PERIHELION OF COMET

● = POSITION OF COMET AT STATED NUMBER OF DAYS BEFORE PERIHELION

O = PREDICTED POSITIONS OF EARTH AT PERIHELION OF COMET

→ = LINE OF SIGHT VECTORS FROM EARTH TO COMET ON Mar 20, May 9, July 8, AND Aug 7

Figure 2. Comet Tempel 2 1988 Observing Conditions

TABLE 1 Orbit Solutions

Orbit	Observation Interval	No. Obs	Mean Residual	Nongravitational Parameters $A_1 \times 10^8$	$A_2 \times 10^8$	Comments
1	1956–1977	91	1.42"	————	————	Residual trends to 6"
2	1956–1977	91	0.96"	+0.0815±0.0085	+0.00245±0.00028	No residual trends
3	1946–1977	128	1.36"	-0.0156±0.0053	+0.00245±0.00000	Residual trends to 6"

TABLE 2 Nongravitational Parameters

Perihelion Distance	Eccen.	Interval	Mean Residual	$A_1 \times 10^8$	$A_2 \times 10^8$	Source
1.4	0.6	1873–1915	1.40"	+0.1	+0.002	Marsden & Sekanina (1971)
1.3	0.6	1904–1946	2.31"	0.0	+0.002	Marsden & Sekanina (1971)
1.3	0.6	1915–1956	1.98"	0.0	+0.001	Marsden & Sekanina (1971)
1.4	0.6	1930–1967	1.41"	0.0	+0.001	Marsden & Sekanina (1971)
1.4	0.6	1956–1977	0.96"	0.0	+0.002	Yeomans

TABLE 3 Orbital Elements from Orbit No. 2

Epoch (E.T.)	Perihelion Passage (E.T.)	q (AU)	e	ω (degrees, 1950.0)	Ω	i	P yrs
1988 Oct. 6.0	1988 Sept.16.7369	1.383429	0.544428	191.0386	119.1182	12.4319	5.29
1983 May 26.0	1983 June 1.5372	1.381404	0.544893	190.9220	119.1579	12.4375	5.29
1978 Feb.21.0	1978 Feb. 20.7295	1.369385	0.547833	190.9336	119.2429	12.4680	5.27
1972 Nov.19.0	1972 Nov. 15.0380	1.364387	0.548887	190.8729	119.2699	12.4804	5.26
1967 Aug.18.0	1967 Aug. 14.2501	1.366510	0.548395	190.9787	119.2716	12.4739	5.26
1962 May 16.0	1962 May 12.6907	1.363959	0.548987	191.0531	119.2767	12.4819	5.26
1957 Feb.11.0	1957 Feb. 5.2012	1.369265	0.547682	191.0343	119.2810	12.4702	5.27

TABLE 4 Orbital Error Analysis

Date (1988)	r AU	Δ AU	θ Deg.	σ_R Km	σ_N Km	σ_T Km	$\sigma_{\dot{R}}$ m/s	$\sigma_{\dot{N}}$ m/s	$\sigma_{\dot{T}}$ m/s
Mar. 20	2.23	1.58	119	2872	1522	2338	0.128	0.076	0.166
30	2.17	1.43	126						
Apr. 9	2.11	1.28	134	2583	1108	1303	0.082	0.076	0.163
19	2.04	1.16	142						
29	1.98	1.05	149						
May 9	1.92	0.95	154	2403	789	694	0.070	0.080	0.158
19	1.85	0.88	156						
29	1.79	0.83	153						
Jun. 8	1.73	0.79	147	2250	602	914	0.084	0.088	0.146
18	1.68	0.78	138						
29	1.62	0.77	130						
Jul. 8	1.57	0.77	122	2015	448	1626	0.128	0.098	0.127
18	1.53	0.79	115						
28	1.49	0.80	109						
Aug. 7	1.45	0.82	104	1471	388	1993	0.174	0.100	0.093
17	1.42	0.85	99						
27	1.40	0.88	96	1069	431	1870	0.183	0.092	0.076
Sep. 6	1.39	0.91	92						
16	1.38	0.95	90	807	475	1638	0.176	0.079	0.073
				(755)	(396)	(1394)	(0.163)	(0.064)	(0.068)

APPENDIX A

EPHEMERIS (WITH PERTURBATIONS)
FOR COMET TEMPEL-2

EPHEMERIS (WITH PERTURBATIONS) FOR COMET TEMPEL-2

YR	MN	DY	HR	J.D.	R.A. 1950.0	DEC.	R.A. DATE	DEC.	DELTA	R	TMAG	NMAG	THETA	BETA	LAT	LONG
1978	7	31	.0	2443720.5	4 21.303	+10 29.50	4 22.875	+10 33.45	2.370	2.100	.00	19.75	62.31	25.33	-12.3	39.5
1978	8	1	.0	2443721.5	4 22.859	+10 30.94	4 24.431	+10 34.84	2.366	2.107	.00	19.75	62.87	25.39	-12.3	39.8
1978	8	2	.0	2443722.5	4 24.397	+10 32.28	4 25.970	+10 36.11	2.363	2.113	.00	19.75	63.43	25.43	-12.3	40.1
1978	8	3	.0	2443723.5	4 25.920	+10 33.50	4 27.493	+10 37.28	2.359	2.120	.00	19.76	64.00	25.48	-12.2	40.5
1978	8	4	.0	2443724.5	4 27.425	+10 34.62	4 29.000	+10 38.34	2.354	2.126	.00	19.76	64.57	25.53	-12.2	40.8
1978	8	5	.0	2443725.5	4 28.914	+10 35.62	4 30.489	+10 39.29	2.350	2.133	.00	19.77	65.15	25.57	-12.2	41.1
1978	8	6	.0	2443726.5	4 30.386	+10 36.53	4 31.961	+10 40.14	2.346	2.139	.00	19.77	65.73	25.61	-12.2	41.4
1978	8	7	.0	2443727.5	4 31.840	+10 37.32	4 33.416	+10 40.88	2.342	2.146	.00	19.78	66.32	25.65	-12.2	41.7
1978	8	8	.0	2443728.5	4 33.277	+10 38.01	4 34.854	+10 41.51	2.337	2.152	.00	19.78	66.91	25.68	-12.2	42.1
1978	8	9	.0	2443729.5	4 34.696	+10 38.60	4 36.274	+10 42.05	2.333	2.159	.00	19.78	67.51	25.72	-12.2	42.4
1978	8	10	.0	2443730.5	4 36.098	+10 39.09	4 37.676	+10 42.48	2.328	2.165	.00	19.79	68.11	25.75	-12.1	42.7
1978	8	11	.0	2443731.5	4 37.482	+10 39.48	4 39.060	+10 42.81	2.324	2.172	.00	19.79	68.71	25.78	-12.1	43.0
1978	8	12	.0	2443732.5	4 38.847	+10 39.76	4 40.426	+10 43.05	2.319	2.178	.00	19.79	69.32	25.80	-12.1	43.3
1978	8	13	.0	2443733.5	4 40.194	+10 39.95	4 41.773	+10 43.18	2.314	2.185	.00	19.79	69.94	25.82	-12.1	43.6
1978	8	14	.0	2443734.5	4 41.523	+10 40.05	4 43.103	+10 43.22	2.309	2.191	.00	19.80	70.55	25.85	-12.1	43.9
1978	8	15	.0	2443735.5	4 42.834	+10 40.04	4 44.413	+10 43.17	2.304	2.198	.00	19.80	71.18	25.86	-12.1	44.2
1978	8	16	.0	2443736.5	4 44.125	+10 39.94	4 45.705	+10 43.02	2.299	2.204	.00	19.80	71.81	25.88	-12.0	44.5
1978	8	17	.0	2443737.5	4 45.398	+10 39.75	4 46.978	+10 42.78	2.294	2.210	.00	19.80	72.44	25.89	-12.0	44.8
1978	8	18	.0	2443738.5	4 46.652	+10 39.47	4 48.232	+10 42.45	2.289	2.217	.00	19.80	73.08	25.90	-12.0	45.1
1978	8	19	.0	2443739.5	4 47.886	+10 39.10	4 49.467	+10 42.02	2.284	2.223	.00	19.81	73.72	25.91	-12.0	45.4
1978	8	20	.0	2443740.5	4 49.101	+10 38.63	4 50.683	+10 41.51	2.278	2.230	.00	19.81	74.37	25.91	-12.0	45.7
1978	8	21	.0	2443741.5	4 50.297	+10 38.08	4 51.878	+10 40.91	2.273	2.236	.00	19.81	75.02	25.91	-12.0	46.0
1978	8	22	.0	2443742.5	4 51.473	+10 37.44	4 53.054	+10 40.23	2.267	2.243	.00	19.81	75.68	25.91	-11.9	46.3
1978	8	23	.0	2443743.5	4 52.628	+10 36.72	4 54.210	+10 39.46	2.262	2.249	.00	19.81	76.35	25.91	-11.9	46.6
1978	8	24	.0	2443744.5	4 53.764	+10 35.91	4 55.346	+10 38.60	2.256	2.256	.00	19.81	77.01	25.90	-11.9	46.9
1978	8	25	.0	2443745.5	4 54.878	+10 35.01	4 56.461	+10 37.67	2.251	2.262	.00	19.81	77.69	25.89	-11.9	47.2
1978	8	26	.0	2443746.5	4 55.972	+10 34.04	4 57.555	+10 36.65	2.245	2.268	.00	19.81	78.37	25.87	-11.9	47.5
1978	8	27	.0	2443747.5	4 57.045	+10 32.98	4 58.628	+10 35.55	2.239	2.275	.00	19.81	79.05	25.85	-11.8	47.7
1978	8	28	.0	2443748.5	4 58.097	+10 31.85	4 59.679	+10 34.37	2.233	2.281	.00	19.81	79.75	25.83	-11.8	48.0
1978	8	29	.0	2443749.5	4 59.127	+10 30.63	5 .709	+10 33.11	2.227	2.288	.00	19.81	80.44	25.81	-11.8	48.3
1978	8	30	.0	2443750.5	5 .135	+10 29.34	5 1.717	+10 31.78	2.221	2.294	.00	19.81	81.14	25.78	-11.8	48.6
1978	8	31	.0	2443751.5	5 1.121	+10 27.98	5 2.703	+10 30.38	2.215	2.300	.00	19.81	81.85	25.75	-11.8	48.9
1978	9	1	.0	2443752.5	5 2.084	+10 26.54	5 3.667	+10 28.90	2.209	2.307	.00	19.81	82.57	25.71	-11.7	49.1
1978	9	2	.0	2443753.5	5 3.025	+10 25.02	5 4.608	+10 27.35	2.203	2.313	.00	19.81	83.28	25.67	-11.7	49.4
1978	9	3	.0	2443754.5	5 3.944	+10 23.44	5 5.526	+10 25.73	2.197	2.320	.00	19.80	84.01	25.63	-11.7	49.7
1978	9	4	.0	2443755.5	5 4.839	+10 21.79	5 6.421	+10 24.04	2.191	2.326	.00	19.80	84.74	25.58	-11.7	50.0
1978	9	5	.0	2443756.5	5 5.710	+10 20.07	5 7.293	+10 22.28	2.184	2.332	.00	19.80	85.48	25.53	-11.7	50.2
1978	9	6	.0	2443757.5	5 6.558	+10 18.28	5 8.141	+10 20.46	2.178	2.339	.00	19.80	86.22	25.47	-11.6	50.5
1978	9	7	.0	2443758.5	5 7.382	+10 16.43	5 8.965	+10 18.58	2.172	2.345	.00	19.80	86.97	25.41	-11.6	50.8
1978	9	8	.0	2443759.5	5 8.182	+10 14.52	5 9.765	+10 16.63	2.165	2.352	.00	19.79	87.72	25.35	-11.6	51.0
1978	9	9	.0	2443760.5	5 8.958	+10 12.54	5 10.540	+10 14.63	2.159	2.358	.00	19.79	88.49	25.28	-11.6	51.3
1978	9	10	.0	2443761.5	5 9.709	+10 10.51	5 11.291	+10 12.56	2.152	2.364	.00	19.79	89.25	25.21	-11.6	51.5
1978	9	11	.0	2443762.5	5 10.436	+10 8.41	5 12.018	+10 10.44	2.146	2.371	.00	19.79	90.03	25.13	-11.5	51.8
1978	9	12	.0	2443763.5	5 11.137	+10 6.27	5 12.719	+10 8.26	2.139	2.377	.00	19.78	90.81	25.05	-11.5	52.1
1978	9	13	.0	2443764.5	5 11.814	+10 4.06	5 13.395	+10 6.03	2.133	2.383	.00	19.78	91.59	24.96	-11.5	52.3
1978	9	14	.0	2443765.5	5 12.465	+10 1.81	5 14.046	+10 3.75	2.126	2.390	.00	19.78	92.38	24.87	-11.5	52.6
1978	9	15	.0	2443766.5	5 13.090	+ 9 59.50	5 14.671	+10 1.42	2.120	2.396	.00	19.77	93.18	24.78	-11.5	52.8
1978	9	16	.0	2443767.5	5 13.690	+ 9 57.15	5 15.271	+ 9 59.04	2.113	2.402	.00	19.77	93.99	24.68	-11.4	53.1
1978	9	17	.0	2443768.5	5 14.264	+ 9 54.74	5 15.844	+ 9 56.61	2.106	2.409	.00	19.76	94.80	24.57	-11.4	53.3
1978	9	18	.0	2443769.5	5 14.811	+ 9 52.30	5 16.391	+ 9 54.14	2.100	2.415	.00	19.76	95.61	24.46	-11.4	53.6
1978	9	19	.0	2443770.5	5 15.332	+ 9 49.80	5 16.912	+ 9 51.63	2.093	2.421	.00	19.75	96.44	24.35	-11.4	53.8
1978	9	20	.0	2443771.5	5 15.826	+ 9 47.27	5 17.406	+ 9 49.08	2.087	2.428	.00	19.75	97.27	24.23	-11.3	54.1
1978	9	21	.0	2443772.5	5 16.293	+ 9 44.70	5 17.872	+ 9 46.48	2.080	2.434	.00	19.74	98.11	24.10	-11.3	54.3
1978	9	22	.0	2443773.5	5 16.733	+ 9 42.08	5 18.312	+ 9 43.85	2.073	2.440	.00	19.74	98.95	23.97	-11.3	54.6

YR	MN	DY	HR	J.D.	R.A. 1950.0	DEC.	R.A. DATE	DEC.	DELTA	R	TMAG	NMAG	THETA	BETA	LAT	LONG
1978	9	23	.0	2443774.5	5 17.145	+ 9 39.43	5 18.724	+ 9 41.18	2.067	2.446	.00	19.73	99.80	23.84	-11.3	54.8
1978	9	24	.0	2443775.5	5 17.529	+ 9 36.75	5 19.108	+ 9 38.48	2.060	2.453	.00	19.73	100.66	23.70	-11.3	55.1
1978	9	25	.0	2443776.5	5 17.885	+ 9 34.03	5 19.463	+ 9 35.75	2.054	2.459	.00	19.72	101.53	23.56	-11.2	55.3
1978	9	26	.0	2443777.5	5 18.213	+ 9 31.28	5 19.791	+ 9 32.99	2.047	2.465	.00	19.72	102.40	23.41	-11.2	55.5
1978	9	27	.0	2443778.5	5 18.512	+ 9 28.50	5 20.090	+ 9 30.20	2.041	2.471	.00	19.71	103.28	23.25	-11.2	55.8
1978	9	28	.0	2443779.5	5 18.783	+ 9 25.70	5 20.360	+ 9 27.38	2.034	2.478	.00	19.70	104.16	23.09	-11.2	56.0
1978	9	29	.0	2443780.5	5 19.024	+ 9 22.87	5 20.601	+ 9 24.55	2.028	2.484	.00	19.70	105.06	22.92	-11.1	56.3
1978	9	30	.0	2443781.5	5 19.236	+ 9 20.02	5 20.812	+ 9 21.69	2.021	2.490	.00	19.69	105.96	22.75	-11.1	56.5
1978	10	1	.0	2443782.5	5 19.419	+ 9 17.15	5 20.995	+ 9 18.81	2.015	2.496	.00	19.68	106.86	22.57	-11.1	56.7
1978	10	2	.0	2443783.5	5 19.572	+ 9 14.26	5 21.147	+ 9 15.92	2.008	2.503	.00	19.68	107.78	22.39	-11.1	57.0
1978	10	3	.0	2443784.5	5 19.695	+ 9 11.36	5 21.270	+ 9 13.01	2.002	2.509	.00	19.67	108.70	22.20	-11.1	57.2
1978	10	4	.0	2443785.5	5 19.788	+ 9 8.44	5 21.363	+ 9 10.09	1.996	2.515	.00	19.66	109.63	22.00	-11.0	57.4
1978	10	5	.0	2443786.5	5 19.851	+ 9 5.52	5 21.426	+ 9 7.16	1.990	2.521	.00	19.66	110.56	21.80	-11.0	57.7
1978	10	6	.0	2443787.5	5 19.885	+ 9 2.58	5 21.459	+ 9 4.22	1.984	2.527	.00	19.65	111.51	21.59	-11.0	57.9
1978	10	7	.0	2443788.5	5 19.888	+ 8 59.64	5 21.461	+ 9 1.28	1.977	2.534	.00	19.64	112.46	21.38	-11.0	58.1
1978	10	8	.0	2443789.5	5 19.860	+ 8 56.70	5 21.433	+ 8 58.34	1.971	2.540	.00	19.63	113.41	21.16	-10.9	58.3
1978	10	9	.0	2443790.5	5 19.803	+ 8 53.76	5 21.376	+ 8 55.40	1.966	2.546	.00	19.62	114.38	20.94	-10.9	58.6
1978	10	10	.0	2443791.5	5 19.715	+ 8 50.81	5 21.287	+ 8 52.46	1.960	2.552	.00	19.62	115.35	20.71	-10.9	58.8
1978	10	11	.0	2443792.5	5 19.597	+ 8 47.88	5 21.169	+ 8 49.53	1.954	2.558	.00	19.61	116.32	20.47	-10.9	59.0
1978	10	12	.0	2443793.5	5 19.449	+ 8 44.95	5 21.020	+ 8 46.61	1.948	2.564	.00	19.60	117.31	20.23	-10.8	59.2
1978	10	13	.0	2443794.5	5 19.270	+ 8 42.03	5 20.841	+ 8 43.69	1.943	2.571	.00	19.59	118.30	19.98	-10.8	59.4
1978	10	14	.0	2443795.5	5 19.061	+ 8 39.12	5 20.632	+ 8 40.79	1.937	2.577	.00	19.58	119.30	19.73	-10.8	59.7
1978	10	15	.0	2443796.5	5 18.823	+ 8 36.22	5 20.393	+ 8 37.91	1.932	2.583	.00	19.57	120.30	19.47	-10.8	59.9
1978	10	16	.0	2443797.5	5 18.559	+ 8 33.35	5 20.123	+ 8 35.04	1.927	2.589	.00	19.57	121.31	19.21	-10.7	60.1
1978	10	17	.0	2443798.5	5 18.255	+ 8 30.49	5 19.824	+ 8 32.20	1.922	2.595	.00	19.56	122.33	18.94	-10.7	60.3
1978	10	18	.0	2443799.5	5 17.926	+ 8 27.66	5 19.495	+ 8 29.38	1.917	2.601	.00	19.55	123.35	18.66	-10.7	60.5
1978	10	19	.0	2443800.5	5 17.567	+ 8 24.85	5 19.136	+ 8 26.58	1.912	2.607	.00	19.54	124.38	18.38	-10.7	60.7
1978	10	20	.0	2443801.5	5 17.179	+ 8 22.06	5 18.747	+ 8 23.82	1.907	2.613	.00	19.53	125.41	18.09	-10.7	61.0
1978	10	21	.0	2443802.5	5 16.761	+ 8 19.31	5 18.328	+ 8 21.08	1.902	2.619	.00	19.52	126.46	17.80	-10.6	61.2
1978	10	22	.0	2443803.5	5 16.313	+ 8 16.59	5 17.880	+ 8 18.38	1.898	2.625	.00	19.51	127.50	17.50	-10.6	61.4
1978	10	23	.0	2443804.5	5 15.836	+ 8 13.91	5 17.403	+ 8 15.72	1.894	2.631	.00	19.50	128.56	17.20	-10.6	61.6
1978	10	24	.0	2443805.5	5 15.331	+ 8 11.27	5 16.897	+ 8 13.10	1.890	2.637	.00	19.49	129.61	16.89	-10.6	61.8
1978	10	25	.0	2443806.5	5 14.796	+ 8 8.66	5 16.363	+ 8 10.52	1.886	2.644	.00	19.49	130.68	16.58	-10.5	62.0
1978	10	26	.0	2443807.5	5 14.234	+ 8 6.10	5 15.800	+ 8 7.98	1.882	2.650	.00	19.48	131.75	16.26	-10.5	62.2
1978	10	27	.0	2443808.5	5 13.643	+ 8 3.59	5 15.208	+ 8 5.49	1.878	2.656	.00	19.47	132.82	15.93	-10.5	62.4
1978	10	28	.0	2443809.5	5 13.024	+ 8 1.13	5 14.590	+ 8 3.06	1.875	2.662	.00	19.46	133.90	15.61	-10.5	62.6
1978	10	29	.0	2443810.5	5 12.379	+ 7 58.72	5 13.944	+ 8 .68	1.871	2.668	.00	19.45	134.98	15.27	-10.4	62.8
1978	10	30	.0	2443811.5	5 11.706	+ 7 56.37	5 13.271	+ 7 58.35	1.868	2.674	.00	19.44	136.06	14.94	-10.4	63.0
1978	10	31	.0	2443812.5	5 11.008	+ 7 54.07	5 12.572	+ 7 56.09	1.865	2.680	.00	19.43	137.15	14.60	-10.4	63.2
1978	11	1	.0	2443813.5	5 10.283	+ 7 51.84	5 11.847	+ 7 53.88	1.862	2.686	.00	19.42	138.24	14.25	-10.4	63.4
1978	11	2	.0	2443814.5	5 9.534	+ 7 49.68	5 11.097	+ 7 51.75	1.860	2.692	.00	19.41	139.33	13.90	-10.3	63.6
1978	11	3	.0	2443815.5	5 8.760	+ 7 47.58	5 10.323	+ 7 49.68	1.858	2.697	.00	19.41	140.43	13.55	-10.3	63.8
1978	11	4	.0	2443816.5	5 7.962	+ 7 45.55	5 9.525	+ 7 47.68	1.856	2.703	.00	19.40	141.52	13.19	-10.3	64.0
1978	11	5	.0	2443817.5	5 7.141	+ 7 43.59	5 8.704	+ 7 45.76	1.854	2.709	.00	19.39	142.62	12.84	-10.3	64.2
1978	11	6	.0	2443818.5	5 6.298	+ 7 41.71	5 7.860	+ 7 43.91	1.852	2.715	.00	19.38	143.72	12.48	-10.2	64.4
1978	11	7	.0	2443819.5	5 5.433	+ 7 39.91	5 6.995	+ 7 42.15	1.851	2.721	.00	19.37	144.81	12.11	-10.2	64.6
1978	11	8	.0	2443820.5	5 4.548	+ 7 38.19	5 6.110	+ 7 40.46	1.850	2.727	.00	19.37	145.90	11.75	-10.2	64.8
1978	11	9	.0	2443821.5	5 3.643	+ 7 36.55	5 5.204	+ 7 38.86	1.849	2.733	.00	19.36	146.99	11.39	-10.2	65.0
1978	11	10	.0	2443822.5	5 2.719	+ 7 35.00	5 4.280	+ 7 37.35	1.848	2.739	.00	19.35	148.08	11.02	-10.1	65.2
1978	11	11	.0	2443823.5	5 1.776	+ 7 33.53	5 3.338	+ 7 35.92	1.847	2.745	.00	19.35	149.16	10.66	-10.1	65.4
1978	11	12	.0	2443824.5	5 .817	+ 7 32.16	5 2.378	+ 7 34.59	1.847	2.751	.00	19.34	150.23	10.29	-10.1	65.6
1978	11	13	.0	2443825.5	4 59.841	+ 7 30.88	5 1.402	+ 7 33.35	1.847	2.757	.00	19.33	151.30	9.93	-10.1	65.8
1978	11	14	.0	2443826.5	4 58.850	+ 7 29.69	5 .410	+ 7 32.20	1.848	2.762	.00	19.33	152.35	9.57	-10.0	66.0
1978	11	15	.0	2443827.5	4 57.844	+ 7 28.60	4 59.405	+ 7 31.15	1.848	2.768	.00	19.32	153.39	9.21	-10.0	66.2
1978	11	16	.0	2443828.5	4 56.825	+ 7 27.61	4 58.385	+ 7 30.20	1.849	2.774	.00	19.32	154.42	8.85	-10.0	66.4
1978	11	17	.0	2443829.5	4 55.793	+ 7 26.71	4 57.353	+ 7 29.35	1.850	2.780	.00	19.31	155.43	8.50	-10.0	66.5
1978	11	18	.0	2443830.5	4 54.749	+ 7 25.92	4 56.309	+ 7 28.60	1.852	2.786	.00	19.31	156.43	8.16	-10.0	66.7

YR	MN	DY	HR	J.D.	R.A. 1950.0	DEC.	R.A. DATE	DEC.	DELTA	R	TMAG	MMAG	THETA	BETA	LAT	LONG
1978	11	19	.0	2443831.5	4 53.695	+ 7 25.23	4 55.255	+ 7 27.96	1.853	2.792	.00	19.30	157.40	7.82	-9.9	66.9
1978	11	20	.0	2443832.5	4 52.631	+ 7 24.65	4 54.192	+ 7 27.42	1.855	2.797	.00	19.30	158.34	7.49	-9.9	67.1
1978	11	21	.0	2443833.5	4 51.559	+ 7 24.18	4 53.119	+ 7 26.98	1.857	2.803	.00	19.30	159.25	7.17	-9.9	67.3
1978	11	22	.0	2443834.5	4 50.480	+ 7 23.81	4 52.040	+ 7 26.66	1.860	2.809	.00	19.30	160.13	6.86	-9.9	67.5
1978	11	23	.0	2443835.5	4 49.394	+ 7 23.55	4 50.954	+ 7 26.45	1.863	2.815	.00	19.30	160.96	6.57	-9.8	67.6
1978	11	24	.0	2443836.5	4 48.303	+ 7 23.40	4 49.863	+ 7 26.34	1.866	2.821	.00	19.29	161.75	6.29	-9.8	67.8
1978	11	25	.0	2443837.5	4 47.208	+ 7 23.37	4 48.768	+ 7 26.35	1.869	2.826	.00	19.30	162.48	6.03	-9.8	68.0
1978	11	26	.0	2443838.5	4 46.109	+ 7 23.45	4 47.670	+ 7 26.47	1.873	2.832	.00	19.30	163.15	5.80	-9.8	68.2
1978	11	27	.0	2443839.5	4 45.009	+ 7 23.64	4 46.570	+ 7 26.71	1.877	2.838	.00	19.30	163.75	5.58	-9.7	68.4
1978	11	28	.0	2443840.5	4 43.909	+ 7 23.94	4 45.469	+ 7 27.06	1.881	2.844	.00	19.30	164.28	5.40	-9.7	68.5
1978	11	29	.0	2443841.5	4 42.808	+ 7 24.36	4 44.369	+ 7 27.52	1.886	2.849	.00	19.31	164.71	5.24	-9.7	68.7
1978	11	30	.0	2443842.5	4 41.710	+ 7 24.90	4 43.270	+ 7 28.10	1.891	2.855	.00	19.31	165.05	5.11	-9.7	68.9
1978	12	1	.0	2443843.5	4 40.613	+ 7 25.55	4 42.174	+ 7 28.80	1.896	2.861	.00	19.32	165.29	5.02	-9.6	69.1
1978	12	2	.0	2443844.5	4 39.521	+ 7 26.32	4 41.082	+ 7 29.61	1.901	2.866	.00	19.33	165.42	4.97	-9.6	69.3
1978	12	3	.0	2443845.5	4 38.434	+ 7 27.21	4 39.995	+ 7 30.54	1.907	2.872	.00	19.34	165.45	4.95	-9.6	69.4
1978	12	4	.0	2443846.5	4 37.353	+ 7 28.21	4 38.914	+ 7 31.59	1.913	2.878	.00	19.35	165.36	4.96	-9.6	69.6
1978	12	5	.0	2443847.5	4 36.280	+ 7 29.33	4 37.841	+ 7 32.75	1.920	2.883	.00	19.37	165.17	5.02	-9.5	69.8
1978	12	6	.0	2443848.5	4 35.214	+ 7 30.57	4 36.776	+ 7 34.03	1.926	2.889	.00	19.38	164.88	5.10	-9.5	69.9
1978	12	7	.0	2443849.5	4 34.158	+ 7 31.92	4 35.720	+ 7 35.43	1.933	2.895	.00	19.40	164.49	5.22	-9.5	70.1
1978	12	8	.0	2443850.5	4 33.112	+ 7 33.39	4 34.674	+ 7 36.94	1.941	2.900	.00	19.41	164.01	5.37	-9.5	70.3
1978	12	9	.0	2443851.5	4 32.077	+ 7 34.97	4 33.639	+ 7 38.56	1.948	2.906	.00	19.43	163.45	5.54	-9.4	70.5
1978	12	10	.0	2443852.5	4 31.054	+ 7 36.67	4 32.617	+ 7 40.30	1.956	2.912	.00	19.45	162.82	5.73	-9.4	70.6
1978	12	11	.0	2443853.5	4 30.045	+ 7 38.48	4 31.608	+ 7 42.14	1.964	2.917	.00	19.47	162.13	5.94	-9.4	70.8
1978	12	12	.0	2443854.5	4 29.049	+ 7 40.40	4 30.612	+ 7 44.10	1.973	2.923	.00	19.49	161.38	6.17	-9.4	71.0
1978	12	13	.0	2443855.5	4 28.067	+ 7 42.43	4 29.631	+ 7 46.17	1.982	2.928	.00	19.51	160.59	6.41	-9.3	71.1
1978	12	14	.0	2443856.5	4 27.101	+ 7 44.56	4 28.666	+ 7 48.35	1.991	2.934	.00	19.53	159.75	6.67	-9.3	71.3
1978	12	15	.0	2443857.5	4 26.152	+ 7 46.81	4 27.716	+ 7 50.63	2.000	2.940	.00	19.55	158.88	6.93	-9.3	71.5
1978	12	16	.0	2443858.5	4 25.219	+ 7 49.16	4 26.783	+ 7 53.02	2.010	2.945	.00	19.58	157.97	7.20	-9.3	71.6
1978	12	17	.0	2443859.5	4 24.303	+ 7 51.62	4 25.868	+ 7 55.52	2.020	2.951	.00	19.60	157.04	7.48	-9.2	71.8
1978	12	18	.0	2443860.5	4 23.405	+ 7 54.19	4 24.971	+ 7 58.11	2.030	2.956	.00	19.62	156.08	7.75	-9.2	72.0
1978	12	19	.0	2443861.5	4 22.527	+ 7 56.85	4 24.093	+ 8 .81	2.040	2.962	.00	19.65	155.11	8.04	-9.2	72.1
1978	12	20	.0	2443862.5	4 21.667	+ 7 59.61	4 23.234	+ 8 3.61	2.051	2.967	.00	19.67	154.12	8.32	-9.2	72.3
1978	12	21	.0	2443863.5	4 20.828	+ 8 2.48	4 22.395	+ 8 6.51	2.062	2.973	.00	19.70	153.11	8.61	-9.2	72.5
1978	12	22	.0	2443864.5	4 20.009	+ 8 5.44	4 21.577	+ 8 9.50	2.073	2.978	.00	19.72	152.10	8.89	-9.1	72.6
1978	12	23	.0	2443865.5	4 19.211	+ 8 8.50	4 20.779	+ 8 12.59	2.085	2.984	.00	19.74	151.07	9.18	-9.1	72.8
1978	12	24	.0	2443866.5	4 18.434	+ 8 11.65	4 20.003	+ 8 15.77	2.097	2.989	.00	19.77	150.04	9.46	-9.1	72.9
1978	12	25	.0	2443867.5	4 17.679	+ 8 14.89	4 19.249	+ 8 19.04	2.109	2.995	.00	19.79	149.00	9.74	-9.1	73.1
1978	12	26	.0	2443868.5	4 16.947	+ 8 18.22	4 18.517	+ 8 22.40	2.121	3.000	.00	19.82	147.95	10.02	-9.0	73.3
1978	12	27	.0	2443869.5	4 16.237	+ 8 21.65	4 17.808	+ 8 25.85	2.134	3.006	.00	19.84	146.90	10.29	-9.0	73.4
1978	12	28	.0	2443870.5	4 15.551	+ 8 25.15	4 17.122	+ 8 29.39	2.146	3.011	.00	19.87	145.85	10.56	-9.0	73.6
1978	12	29	.0	2443871.5	4 14.888	+ 8 28.75	4 16.460	+ 8 33.01	2.159	3.017	.00	19.89	144.79	10.83	-9.0	73.7
1978	12	30	.0	2443872.5	4 14.249	+ 8 32.42	4 15.822	+ 8 36.71	2.173	3.022	.00	19.92	143.74	11.10	-8.9	73.9
1978	12	31	.0	2443873.5	4 13.634	+ 8 36.18	4 15.207	+ 8 40.49	2.186	3.028	.00	19.94	142.68	11.36	-8.9	74.1
1979	1	1	.0	2443874.5	4 13.043	+ 8 40.02	4 14.617	+ 8 44.34	2.200	3.033	.00	19.97	141.62	11.61	-8.9	74.2
1979	1	2	.0	2443875.5	4 12.477	+ 8 43.93	4 14.052	+ 8 48.28	2.214	3.038	.00	19.99	140.57	11.86	-8.9	74.4
1979	1	3	.0	2443876.5	4 11.936	+ 8 47.91	4 13.511	+ 8 52.29	2.228	3.044	.00	20.02	139.51	12.11	-8.8	74.5
1979	1	4	.0	2443877.5	4 11.419	+ 8 51.97	4 12.995	+ 8 56.36	2.243	3.049	.00	20.05	138.46	12.35	-8.8	74.7
1979	1	5	.0	2443878.5	4 10.928	+ 8 56.10	4 12.505	+ 9 .51	2.257	3.054	.00	20.07	137.41	12.58	-8.8	74.8
1979	1	6	.0	2443879.5	4 10.461	+ 9 .30	4 12.039	+ 9 4.73	2.272	3.060	.00	20.10	136.36	12.81	-8.8	75.0
1979	1	7	.0	2443880.5	4 10.020	+ 9 4.56	4 11.598	+ 9 9.00	2.287	3.065	.00	20.12	135.31	13.04	-8.7	75.1
1979	1	8	.0	2443881.5	4 9.603	+ 9 8.88	4 11.183	+ 9 13.35	2.302	3.071	.00	20.14	134.27	13.26	-8.7	75.3
1979	1	9	.0	2443882.5	4 9.212	+ 9 13.27	4 10.792	+ 9 17.75	2.318	3.076	.00	20.17	133.23	13.47	-8.7	75.4
1979	1	10	.0	2443883.5	4 8.845	+ 9 17.72	4 10.426	+ 9 22.21	2.333	3.081	.00	20.19	132.19	13.68	-8.7	75.6
1979	1	11	.0	2443884.5	4 8.504	+ 9 22.22	4 10.085	+ 9 26.72	2.349	3.087	.00	20.22	131.16	13.88	-8.7	75.7
1979	1	12	.0	2443885.5	4 8.187	+ 9 26.77	4 9.770	+ 9 31.29	2.365	3.092	.00	20.24	130.13	14.08	-8.6	75.9
1979	1	13	.0	2443886.5	4 7.895	+ 9 31.38	4 9.478	+ 9 35.91	2.381	3.097	.00	20.27	129.10	14.27	-8.6	76.0
1979	1	14	.0	2443887.5	4 7.627	+ 9 36.04	4 9.212	+ 9 40.58	2.398	3.102	.00	20.29	128.08	14.45	-8.6	76.2

YR	MO	DY	HR	J.D.	R.A. 1950.0	DEC.	R.A. DATE	DEC.	DELTA	R	TMAG	NMAG	THETA	BETA	LAT	LONG
1979	1	15	.0	2443888.5	4 7.385	+ 9 40.75	4 8.970	+ 9 45.29	2.414	3.108	.00	20.31	127.06	14.63	-8.6	76.3
1979	1	16	.0	2443889.5	4 7.166	+ 9 45.50	4 8.752	+ 9 50.06	2.431	3.113	.00	20.34	126.05	14.80	-8.5	76.5
1979	1	17	.0	2443890.5	4 6.972	+ 9 50.30	4 8.559	+ 9 54.86	2.448	3.118	.00	20.36	125.04	14.97	-8.5	76.6
1979	1	18	.0	2443891.5	4 6.802	+ 9 55.14	4 8.390	+ 9 59.71	2.465	3.123	.00	20.39	124.03	15.13	-8.5	76.8
1979	1	19	.0	2443892.5	4 6.655	+10 .02	4 8.244	+10 4.60	2.482	3.129	.00	20.41	123.03	15.29	-8.5	76.9
1979	1	20	.0	2443893.5	4 6.533	+10 4.94	4 8.123	+10 9.52	2.499	3.134	.00	20.43	122.04	15.44	-8.4	77.1
1979	1	21	.0	2443894.5	4 6.434	+10 9.90	4 8.025	+10 14.48	2.516	3.139	.00	20.46	121.04	15.58	-8.4	77.2
1979	1	22	.0	2443895.5	4 6.359	+10 14.89	4 7.951	+10 19.48	2.534	3.144	.00	20.48	120.06	15.72	-8.4	77.4
1979	1	23	.0	2443896.5	4 6.307	+10 19.92	4 7.900	+10 24.51	2.551	3.150	.00	20.50	119.07	15.85	-8.4	77.5
1979	1	24	.0	2443897.5	4 6.278	+10 24.97	4 7.872	+10 29.57	2.569	3.155	.00	20.52	118.09	15.98	-8.3	77.7
1979	1	25	.0	2443898.5	4 6.272	+10 30.06	4 7.867	+10 34.65	2.587	3.160	.00	20.55	117.12	16.10	-8.3	77.8
1979	1	26	.0	2443899.5	4 6.289	+10 35.18	4 7.885	+10 39.77	2.605	3.165	.00	20.57	116.15	16.21	-8.3	77.9
1979	1	27	.0	2443900.5	4 6.328	+10 40.32	4 7.925	+10 44.91	2.623	3.170	.00	20.59	115.19	16.32	-8.3	78.1
1979	1	28	.0	2443901.5	4 6.390	+10 45.49	4 7.988	+10 50.07	2.642	3.175	.00	20.61	114.23	16.43	-8.3	78.2
1979	1	29	.0	2443902.5	4 6.474	+10 50.67	4 8.073	+10 55.26	2.660	3.180	.00	20.63	113.27	16.53	-8.2	78.4
1979	1	30	.0	2443903.5	4 6.579	+10 55.89	4 8.180	+11 .47	2.678	3.186	.00	20.65	112.32	16.62	-8.2	78.5
1979	1	31	.0	2443904.5	4 6.707	+11 1.12	4 8.308	+11 5.70	2.697	3.191	.00	20.68	111.37	16.71	-8.2	78.7
1979	2	1	.0	2443905.5	4 6.856	+11 6.37	4 8.458	+11 10.94	2.716	3.196	.00	20.70	110.43	16.79	-8.2	78.8
1979	2	2	.0	2443906.5	4 7.025	+11 11.63	4 8.629	+11 16.20	2.734	3.201	.00	20.72	109.50	16.87	-8.1	78.9
1979	2	3	.0	2443907.5	4 7.216	+11 16.91	4 8.821	+11 21.47	2.753	3.206	.00	20.74	108.56	16.94	-8.1	79.1
1979	2	4	.0	2443908.5	4 7.427	+11 22.20	4 9.033	+11 26.76	2.772	3.211	.00	20.76	107.64	17.01	-8.1	79.2
1979	2	5	.0	2443909.5	4 7.659	+11 27.51	4 9.266	+11 32.05	2.791	3.216	.00	20.78	106.71	17.07	-8.1	79.4
1979	2	6	.0	2443910.5	4 7.910	+11 32.82	4 9.518	+11 37.36	2.810	3.221	.00	20.80	105.79	17.13	-8.0	79.5
1979	2	7	.0	2443911.5	4 8.181	+11 38.1[illegible]	4 9.790	+11 42.67	2.829	3.226	.00	20.82	104.88	17.18	-8.0	79.6
1979	2	8	.0	2443912.5	4 8.471	+11 43.47	4 10.082	+11 47.99	2.848	3.231	.00	20.84	103.97	17.23	-8.0	79.8
1979	2	9	.0	2443913.5	4 8.781	+11 48.81	4 10.392	+11 53.31	2.867	3.236	.00	20.86	103.06	17.27	-8.0	79.9
1979	2	10	.0	2443914.5	4 9.109	+11 54.15	4 10.722	+11 58.64	2.887	3.241	.00	20.87	102.16	17.31	-8.0	80.0
1979	2	11	.0	2443915.5	4 9.456	+11 59.49	4 11.069	+12 3.97	2.906	3.246	.00	20.89	101.27	17.35	-7.9	80.2
1979	2	12	.0	2443916.5	4 9.820	+12 4.83	4 11.435	+12 9.30	2.925	3.251	.00	20.91	100.37	17.37	-7.9	80.3
1979	2	13	.0	2443917.5	4 10.203	+12 10.17	4 11.819	+12 14.63	2.945	3.256	.00	20.93	99.49	17.40	-7.9	80.4
1979	2	14	.0	2443918.5	4 10.603	+12 15.52	4 12.221	+12 19.95	2.964	3.261	.00	20.95	98.60	17.42	-7.9	80.6
1979	2	15	.0	2443919.5	4 11.021	+12 20.86	4 12.640	+12 25.28	2.984	3.266	.00	20.97	97.72	17.44	-7.8	80.7
1979	2	16	.0	2443920.5	4 11.456	+12 26.19	4 13.076	+12 30.60	3.003	3.271	.00	20.98	96.85	17.45	-7.8	80.8
1979	2	17	.0	2443921.5	4 11.908	+12 31.52	4 13.529	+12 35.91	3.023	3.276	.00	21.00	95.97	17.45	-7.8	81.0
1979	2	18	.0	2443922.5	4 12.376	+12 36.85	4 13.998	+12 41.22	3.042	3.281	.00	21.02	95.10	17.46	-7.8	81.1
1979	2	19	.0	2443923.5	4 12.861	+12 42.17	4 14.484	+12 46.52	3.062	3.286	.00	21.04	94.24	17.46	-7.8	81.2
1979	2	20	.0	2443924.5	4 13.361	+12 47.48	4 14.986	+12 51.81	3.081	3.291	.00	21.05	93.38	17.45	-7.7	81.4
1979	2	21	.0	2443925.5	4 13.878	+12 52.78	4 15.504	+12 57.09	3.101	3.296	.00	21.07	92.52	17.44	-7.7	81.5
1979	2	22	.0	2443926.5	4 14.410	+12 58.07	4 16.038	+13 2.36	3.121	3.301	.00	21.09	91.67	17.43	-7.7	81.6
1979	2	23	.0	2443927.5	4 14.958	+13 3.35	4 16.587	+13 7.62	3.140	3.306	.00	21.10	90.82	17.41	-7.7	81.8
1979	2	24	.0	2443928.5	4 15.521	+13 8.62	4 17.151	+13 12.87	3.160	3.311	.00	21.12	89.97	17.39	-7.6	81.9
1979	2	25	.0	2443929.5	4 16.099	+13 13.87	4 17.730	+13 18.10	3.179	3.316	.00	21.14	89.13	17.37	-7.6	82.0
1979	2	26	.0	2443930.5	4 16.692	+13 19.11	4 18.324	+13 23.32	3.199	3.320	.00	21.15	88.29	17.34	-7.6	82.2
1979	2	27	.0	2443931.5	4 17.299	+13 24.33	4 18.933	+13 28.52	3.219	3.325	.00	21.17	87.45	17.31	-7.6	82.3
1979	2	28	.0	2443932.5	4 17.921	+13 29.54	4 19.556	+13 33.71	3.238	3.330	.00	21.18	86.62	17.27	-7.5	82.4
1979	3	1	.0	2443933.5	4 18.556	+13 34.73	4 20.193	+13 38.87	3.258	3.335	.00	21.20	85.79	17.23	-7.5	82.5
1979	3	2	.0	2443934.5	4 19.206	+13 39.91	4 20.843	+13 44.02	3.277	3.340	.00	21.21	84.97	17.19	-7.5	82.7
1979	3	3	.0	2443935.5	4 19.869	+13 45.06	4 21.507	+13 49.15	3.297	3.345	.00	21.23	84.14	17.15	-7.5	82.8
1979	3	4	.0	2443936.5	4 20.545	+13 50.19	4 22.185	+13 54.26	3.317	3.349	.00	21.24	83.33	17.10	-7.5	82.9
1979	3	5	.0	2443937.5	4 21.234	+13 55.31	4 22.875	+13 59.35	3.336	3.354	.00	21.26	82.51	17.05	-7.4	83.1
1979	3	6	.0	2443938.5	4 21.935	+14 .40	4 23.578	+14 4.41	3.356	3.359	.00	21.27	81.70	16.99	-7.4	83.2
1979	3	7	.0	2443939.5	4 22.649	+14 5.47	4 24.293	+14 9.45	3.375	3.364	.00	21.28	80.89	16.93	-7.4	83.3
1979	3	8	.0	2443940.5	4 23.376	+14 10.51	4 25.021	+14 14.47	3.394	3.369	.00	21.30	80.08	16.87	-7.4	83.4
1979	3	9	.0	2443941.5	4 24.114	+14 15.53	4 25.761	+14 19.46	3.414	3.373	.00	21.31	79.28	16.81	-7.3	83.6
1979	3	10	.0	2443942.5	4 24.864	+14 20.52	4 26.512	+14 24.42	3.433	3.378	.00	21.32	78.48	16.74	-7.3	83.7
1979	3	11	.0	2443943.5	4 25.626	+14 25.49	4 27.275	+14 29.36	3.452	3.383	.00	21.34	77.68	16.67	-7.3	83.8
1979	3	12	.0	2443944.5	4 26.399	+14 30.43	4 28.049	+14 34.27	3.472	3.387	.00	21.35	76.89	16.60	-7.3	83.9

YR	MN	DY	HR	J.D.	R.A. 1950.0	DEC.	R.A. DATE	DEC.	DELTA	R	TMAG	NMAG	THETA	BETA	LAT	LONG
1979	3	13	.0	2443945.5	4 27.183	+14 35.35	4 28.835	+14 39.16	3.491	3.392	.00	21.36	76.10	16.52	-7.3	84.1
1979	3	14	.0	2443946.5	4 27.978	+14 40.23	4 29.631	+14 44.01	3.510	3.397	.00	21.38	75.31	16.44	-7.2	84.2
1979	3	15	.0	2443947.5	4 28.784	+14 45.09	4 30.438	+14 48.83	3.529	3.402	.00	21.39	74.53	16.36	-7.2	84.3
1979	3	16	.0	2443948.5	4 29.600	+14 49.91	4 31.255	+14 53.63	3.548	3.406	.00	21.40	73.74	16.28	-7.2	84.4
1979	3	17	.0	2443949.5	4 30.426	+14 54.71	4 32.083	+14 58.39	3.567	3.411	.00	21.41	72.96	16.19	-7.2	84.5

EXPLANATION OF SYMBOLS

J.D.= JULIAN DATE
R.A. AND DEC.- 1950.0 ARE RIGHT ASCENSION AND DECLINATION REFERRED TO MEAN EQUATOR AND EQUINOX OF 1950.0
R.A. AND DEC.- DATE ARE RIGHT ASCENSION AND DECLINATION REFERRED TO MEAN EQUATOR AND EQUINOX OF DATE
DELTA= GEOCENTRIC DISTANCE OF OBJECT IN A.U.
R= HELIOCENTRIC DISTANCE OF OBJECT IN A.U.

TMAG=TOTAL MAGNITUDE, COMPUTED FROM EMPIRICAL EQUATION BASED UPON PAST OBSERVED BEHAVIOR
NMAG= NUCLEAR MAGNITUDE = 15.5 + 5.00*DLOG10(DELTA) + 5.00*DLOG10(R) + .03*BETA
NOTE: IN CASES WHERE TMAG AND/OR NMAG ARE NOT COMPUTED, THE CORRESPONDING COLUMN(S) ARE FILLED WITH ZEROES (0.0).

THETA= SUN-EARTH-OBJECT ANGLE IN DEGREES
BETA= SUN-OBJECT-EARTH ANGLE IN DEGREES
LAT AND LONG ARE HELIOCENTRIC ECLIPTIC LATITUDE AND LONGITUDE IN DEG., REFERRED TO 1950.0

THE FOLLOWING OSCULATING ORBITAL ELEMENTS ARE CONSISTENT WITH THE ABOVE EPHEMERIS

EPOCH	2443560.50000	1978	2	21.00000
PERIHELION PASSAGE	2443560.22946	1978	2	20.72946
PERIHELION DISTANCE IN AU	1.3693853			
ECCENTRICITY	.5478328			
ARG. OF PERIHELION	190.93361			
LONG. OF ASCENDING NODE	119.24287			
INCLINATION	12.46801			

ANGLES ARE IN DEGREES AND ARE REFERRED TO THE ECLIPTIC AND EQUINOX OF 1950.0

ORBIT AND EPHEMERIS COMPUTATIONS BY

DR. D.K. YEOMANS
JET PROPULSION LAB.
PASADENA, CALIF. 91103

FIN NIF

ORIGINAL PAGE IS
OF POOR QUALITY

EPHEMERIS (WITH PERTURBATIONS) FOR COMET TEMPEL-2

YR	MN	DY	HR	J.D.	R.A. 1950.0	DEC.	R.A. DATE	DEC.	DELTA	R	THAG	NMAG	THETA	BETA	LAT	LONG
1982	11	1	.0	2445274.5	14 4.570	- 3 12.16	14 6.273	- 3 21.52	3.398	2.435	.00	20.23	11.70	4.74	12.4	206.9
1982	11	3	.0	2445276.5	14 8.108	- 3 31.48	14 9.815	- 3 40.76	3.382	2.422	.00	20.22	12.40	5.05	12.4	207.4
1982	11	5	.0	2445278.5	14 11.678	- 3 50.72	14 13.387	- 3 59.91	3.365	2.410	.00	20.21	13.15	5.37	12.4	207.9
1982	11	7	.0	2445280.5	14 15.279	- 4 9.88	14 16.992	- 4 18.98	3.347	2.397	.00	20.19	13.94	5.71	12.4	208.5
1982	11	9	.0	2445282.5	14 18.912	- 4 28.95	14 20.629	- 4 37.95	3.329	2.385	.00	20.18	14.75	6.07	12.4	209.0
1982	11	11	.0	2445284.5	14 22.578	- 4 47.92	14 24.298	- 4 56.81	3.311	2.372	.00	20.17	15.58	6.44	12.4	209.5
1982	11	13	.0	2445286.5	14 26.276	- 5 6.77	14 28.000	- 5 15.56	3.292	2.359	.00	20.16	16.43	6.82	12.4	210.0
1982	11	15	.0	2445288.5	14 30.007	- 5 25.51	14 31.734	- 5 34.19	3.273	2.347	.00	20.14	17.30	7.20	12.4	210.6
1982	11	17	.0	2445290.5	14 33.772	- 5 44.12	14 35.502	- 5 52.69	3.253	2.334	.00	20.13	18.18	7.60	12.4	211.1
1982	11	19	.0	2445292.5	14 37.569	- 6 2.59	14 39.303	- 6 11.05	3.233	2.321	.00	20.12	19.07	8.00	12.4	211.6
1982	11	21	.0	2445294.5	14 41.400	- 6 20.92	14 43.138	- 6 29.26	3.212	2.309	.00	20.10	19.96	8.40	12.4	212.2
1982	11	23	.0	2445296.5	14 45.264	- 6 39.09	14 47.006	- 6 47.31	3.192	2.296	.00	20.09	20.86	8.81	12.4	212.7
1982	11	25	.0	2445298.5	14 49.163	- 6 57.10	14 50.909	- 7 5.20	3.170	2.283	.00	20.07	21.76	9.23	12.4	213.3
1982	11	27	.0	2445300.5	14 53.096	- 7 14.93	14 54.846	- 7 22.91	3.149	2.270	.00	20.06	22.67	9.64	12.4	213.9
1982	11	29	.0	2445302.5	14 57.063	- 7 32.59	14 58.818	- 7 40.43	3.127	2.258	.00	20.05	23.58	10.06	12.4	214.4
1982	12	1	.0	2445304.5	15 1.067	- 7 50.06	15 2.825	- 7 57.77	3.105	2.245	.00	20.03	24.48	10.49	12.4	215.0
1982	12	3	.0	2445306.5	15 5.106	- 8 7.34	15 6.869	- 8 14.91	3.082	2.232	.00	20.02	25.39	10.92	12.4	215.6
1982	12	5	.0	2445308.5	15 9.182	- 8 24.41	15 10.950	- 8 31.83	3.059	2.219	.00	20.00	26.30	11.35	12.3	216.2
1982	12	7	.0	2445310.5	15 13.296	- 8 41.26	15 15.067	- 8 48.54	3.036	2.206	.00	19.98	27.20	11.78	12.3	216.8
1982	12	9	.0	2445312.5	15 17.447	- 8 57.89	15 19.223	- 9 5.03	3.013	2.194	.00	19.97	28.10	12.21	12.3	217.4
1982	12	11	.0	2445314.5	15 21.636	- 9 14.29	15 23.416	- 9 21.27	2.989	2.181	.00	19.95	29.00	12.65	12.3	218.0
1982	12	13	.0	2445316.5	15 25.863	- 9 30.44	15 27.647	- 9 37.27	2.965	2.168	.00	19.93	29.90	13.08	12.3	218.7
1982	12	15	.0	2445318.5	15 30.128	- 9 46.34	15 31.917	- 9 53.00	2.941	2.155	.00	19.92	30.79	13.52	12.2	219.3
1982	12	17	.0	2445320.5	15 34.432	-10 1.97	15 36.225	-10 8.47	2.916	2.142	.00	19.90	31.68	13.96	12.2	219.9
1982	12	19	.0	2445322.5	15 38.774	-10 17.32	15 40.573	-10 23.65	2.892	2.129	.00	19.88	32.57	14.40	12.2	220.6
1982	12	21	.0	2445324.5	15 43.156	-10 32.38	15 44.959	-10 38.54	2.867	2.117	.00	19.86	33.45	14.84	12.2	221.2
1982	12	23	.0	2445326.5	15 47.577	-10 47.15	15 49.384	-10 53.13	2.842	2.104	.00	19.84	34.32	15.28	12.1	221.9
1982	12	25	.0	2445328.5	15 52.038	-11 1.60	15 53.850	-11 7.40	2.816	2.091	.00	19.82	35.19	15.73	12.1	222.6
1982	12	27	.0	2445330.5	15 56.540	-11 15.74	15 58.356	-11 21.36	2.791	2.078	.00	19.80	36.05	16.17	12.1	223.2
1982	12	29	.0	2445332.5	16 1.082	-11 29.55	16 2.902	-11 34.98	2.765	2.065	.00	19.78	36.91	16.61	12.0	223.9
1982	12	31	.0	2445334.5	16 5.665	-11 43.02	16 7.490	-11 48.25	2.740	2.053	.00	19.76	37.75	17.06	12.0	224.6
1983	1	2	.0	2445336.5	16 10.291	-11 56.14	16 12.120	-12 1.18	2.714	2.040	.00	19.74	38.60	17.50	12.0	225.3
1983	1	4	.0	2445338.5	16 14.959	-12 8.91	16 16.793	-12 13.74	2.688	2.027	.00	19.72	39.43	17.95	11.9	226.0
1983	1	6	.0	2445340.5	16 19.670	-12 21.30	16 21.508	-12 25.93	2.662	2.014	.00	19.70	40.26	18.39	11.9	226.7
1983	1	8	.0	2445342.5	16 24.425	-12 33.31	16 26.267	-12 37.74	2.635	2.001	.00	19.68	41.08	18.84	11.8	227.5
1983	1	10	.0	2445344.5	16 29.222	-12 44.93	16 31.068	-12 49.14	2.609	1.989	.00	19.65	41.90	19.28	11.8	228.2
1983	1	12	.0	2445346.5	16 34.064	-12 56.14	16 35.913	-13 .14	2.583	1.976	.00	19.63	42.70	19.73	11.7	229.0
1983	1	14	.0	2445348.5	16 38.948	-13 6.93	16 40.802	-13 10.71	2.556	1.963	.00	19.61	43.50	20.17	11.7	229.7
1983	1	16	.0	2445350.5	16 43.876	-13 17.29	16 45.734	-13 20.85	2.530	1.951	.00	19.58	44.29	20.62	11.6	230.5
1983	1	18	.0	2445352.5	16 48.848	-13 27.21	16 50.709	-13 30.54	2.503	1.938	.00	19.56	45.07	21.06	11.5	231.3
1983	1	20	.0	2445354.5	16 53.864	-13 36.69	16 55.729	-13 39.78	2.477	1.925	.00	19.54	45.84	21.51	11.5	232.0
1983	1	22	.0	2445356.5	16 58.924	-13 45.69	17 .792	-13 48.56	2.450	1.913	.00	19.51	46.60	21.95	11.4	232.8
1983	1	24	.0	2445358.5	17 4.028	-13 54.23	17 5.899	-13 56.86	2.424	1.900	.00	19.49	47.35	22.40	11.3	233.6
1983	1	26	.0	2445360.5	17 9.177	-14 2.28	17 11.051	-14 4.67	2.397	1.888	.00	19.46	48.10	22.84	11.3	234.5
1983	1	28	.0	2445362.5	17 14.372	-14 9.84	17 16.248	-14 11.99	2.371	1.875	.00	19.44	48.83	23.28	11.2	235.3
1983	1	30	.0	2445364.5	17 19.611	-14 16.90	17 21.491	-14 18.80	2.345	1.863	.00	19.41	49.55	23.73	11.1	236.1
1983	2	1	.0	2445366.5	17 24.897	-14 23.45	17 26.779	-14 25.09	2.318	1.851	.00	19.39	50.26	24.17	11.0	237.0
1983	2	3	.0	2445368.5	17 30.229	-14 29.48	17 32.114	-14 30.86	2.292	1.838	.00	19.36	50.97	24.61	11.0	237.8
1983	2	5	.0	2445370.5	17 35.607	-14 34.96	17 37.494	-14 36.09	2.266	1.826	.00	19.34	51.66	25.05	10.9	238.7
1983	2	7	.0	2445372.5	17 41.031	-14 39.91	17 42.920	-14 40.78	2.240	1.814	.00	19.31	52.34	25.49	10.8	239.6
1983	2	9	.0	2445374.5	17 46.501	-14 44.30	17 48.391	-14 44.90	2.214	1.802	.00	19.28	53.01	25.93	10.7	240.5
1983	2	11	.0	2445376.5	17 52.017	-14 48.12	17 53.908	-14 48.46	2.188	1.790	.00	19.26	53.67	26.37	10.6	241.4
1983	2	13	.0	2445378.5	17 57.577	-14 51.37	17 59.469	-14 51.44	2.163	1.778	.00	19.23	54.31	26.81	10.5	242.3
1983	2	15	.0	2445380.5	18 3.182	-14 54.03	18 5.075	-14 53.83	2.137	1.766	.00	19.20	54.95	27.25	10.4	243.2

YR	MO	DY	HR	J.D.	R.A. 1950.0	DEC.	R.A. DATE	DEC.	DELTA	R	THAG	EMAG	THETA	BETA	LAT	LONG
1983	2	17	.0	2445382.5	18 8.833	-14 56.10	18 10.726	-14 55.63	2.112	1.754	.00	19.17	55.58	27.69	10.2	244.1
1983	2	19	.0	2445384.5	18 14.527	-14 57.58	18 16.421	-14 56.83	2.087	1.742	.00	19.15	56.19	28.12	10.1	245.1
1983	2	21	.0	2445386.5	18 20.266	-14 58.45	18 22.160	-14 57.42	2.062	1.731	.00	19.12	56.79	28.56	10.0	246.1
1983	2	23	.0	2445388.5	18 26.049	-14 58.70	18 27.943	-14 57.40	2.037	1.719	.00	19.09	57.38	28.99	9.9	247.0
1983	2	25	.0	2445390.5	18 31.876	-14 58.34	18 33.770	-14 56.76	2.013	1.708	.00	19.06	57.96	29.42	9.7	248.0
1983	2	27	.0	2445392.5	18 37.748	-14 57.36	18 39.641	-14 55.50	1.988	1.696	.00	19.04	58.52	29.86	9.6	249.0
1983	3	1	.0	2445394.5	18 43.664	-14 55.75	18 45.556	-14 53.61	1.964	1.685	.00	19.01	59.07	30.29	9.5	250.0
1983	3	3	.0	2445396.5	18 49.624	-14 53.51	18 51.514	-14 51.08	1.941	1.674	.00	18.98	59.61	30.72	9.3	251.0
1983	3	5	.0	2445398.5	18 55.627	-14 50.62	18 57.516	-14 47.91	1.917	1.663	.00	18.95	60.14	31.14	9.2	252.1
1983	3	7	.0	2445400.5	19 1.673	-14 47.09	19 3.560	-14 44.10	1.894	1.652	.00	18.92	60.65	31.57	9.0	253.1
1983	3	9	.0	2445402.5	19 7.761	-14 42.92	19 9.646	-14 39.65	1.871	1.641	.00	18.90	61.16	31.99	8.9	254.2
1983	3	11	.0	2445404.5	19 13.890	-14 38.10	19 15.773	-14 34.54	1.848	1.631	.00	18.87	61.65	32.42	8.7	255.3
1983	3	13	.0	2445406.5	19 20.059	-14 32.63	19 21.939	-14 28.79	1.826	1.620	.00	18.84	62.13	32.84	8.5	256.4
1983	3	15	.0	2445408.5	19 26.268	-14 26.51	19 28.145	-14 22.39	1.804	1.610	.00	18.81	62.60	33.26	8.3	257.5
1983	3	17	.0	2445410.5	19 32.514	-14 19.75	19 34.388	-14 15.35	1.782	1.600	.00	18.78	63.05	33.67	8.2	258.6
1983	3	19	.0	2445412.5	19 38.798	-14 12.34	19 40.669	-14 7.67	1.761	1.590	.00	18.76	63.49	34.09	8.0	259.7
1983	3	21	.0	2445414.5	19 45.118	-14 4.30	19 46.985	-13 59.35	1.740	1.580	.00	18.73	63.93	34.50	7.8	260.9
1983	3	23	.0	2445416.5	19 51.474	-13 55.63	19 53.337	-13 50.40	1.719	1.570	.00	18.70	64.35	34.91	7.6	262.0
1983	3	25	.0	2445418.5	19 57.865	-13 46.33	19 59.724	-13 40.83	1.699	1.560	.00	18.68	64.75	35.31	7.4	263.2
1983	3	27	.0	2445420.5	20 4.289	-13 36.41	20 6.144	-13 30.64	1.679	1.551	.00	18.65	65.15	35.71	7.2	264.4
1983	3	29	.0	2445422.5	20 10.748	-13 25.88	20 12.598	-13 19.85	1.659	1.542	.00	18.62	65.53	36.11	7.0	265.5
1983	3	31	.0	2445424.5	20 17.238	-13 14.75	20 19.084	-13 8.45	1.640	1.533	.00	18.60	65.91	36.51	6.7	266.8
1983	4	2	.0	2445426.5	20 23.760	-13 3.02	20 25.601	-12 56.46	1.621	1.524	.00	18.57	66.27	36.90	6.5	268.0
1983	4	4	.0	2445428.5	20 30.311	-12 50.71	20 32.147	-12 43.90	1.602	1.515	.00	18.54	66.62	37.28	6.3	269.2
1983	4	6	.0	2445430.5	20 36.890	-12 37.82	20 38.722	-12 30.77	1.584	1.507	.00	18.52	66.97	37.67	6.0	270.5
1983	4	8	.0	2445432.5	20 43.496	-12 24.39	20 45.322	-12 17.08	1.567	1.499	.00	18.49	67.30	38.04	5.8	271.7
1983	4	10	.0	2445434.5	20 50.126	-12 10.42	20 51.947	-12 2.87	1.549	1.491	.00	18.47	67.63	38.42	5.6	273.0
1983	4	12	.0	2445436.5	20 56.778	-11 55.93	20 58.594	-11 48.15	1.533	1.483	.00	18.45	67.94	38.78	5.3	274.3
1983	4	14	.0	2445438.5	21 3.450	-11 40.95	21 5.261	-11 32.94	1.516	1.476	.00	18.42	68.25	39.14	5.0	275.6
1983	4	16	.0	2445440.5	21 10.141	-11 25.49	21 11.946	-11 17.26	1.500	1.468	.00	18.40	68.55	39.50	4.8	276.9
1983	4	18	.0	2445442.5	21 16.849	-11 9.59	21 18.649	-11 1.14	1.484	1.461	.00	18.38	68.85	39.85	4.5	278.2
1983	4	20	.0	2445444.5	21 23.571	-10 53.26	21 25.365	-10 44.60	1.469	1.455	13.80	18.35	69.14	40.19	4.2	279.5
1983	4	22	.0	2445446.5	21 30.306	-10 36.53	21 32.095	-10 27.67	1.454	1.448	13.59	18.33	69.42	40.52	4.0	280.9
1983	4	24	.0	2445448.5	21 37.052	-10 19.44	21 38.836	-10 10.38	1.440	1.442	13.38	18.31	69.70	40.85	3.7	282.2
1983	4	26	.0	2445450.5	21 43.808	-10 1.99	21 45.587	- 9 52.75	1.426	1.436	13.18	18.29	69.97	41.17	3.4	283.6
1983	4	28	.0	2445452.5	21 50.572	- 9 44.23	21 52.346	- 9 34.81	1.412	1.430	12.98	18.27	70.23	41.48	3.1	285.0
1983	4	30	.0	2445454.5	21 57.341	- 9 26.18	21 59.110	- 9 16.58	1.399	1.425	12.80	18.25	70.50	41.78	2.8	286.3
1983	5	2	.0	2445456.5	22 4.113	- 9 7.87	22 5.877	- 8 58.11	1.386	1.420	12.63	18.23	70.76	42.07	2.5	287.7
1983	5	4	.0	2445458.5	22 10.886	- 8 49.34	22 12.645	- 8 39.42	1.374	1.415	12.46	18.21	71.02	42.35	2.2	289.1
1983	5	6	.0	2445460.5	22 17.656	- 8 30.61	22 19.411	- 8 20.55	1.362	1.411	12.31	18.20	71.28	42.63	1.9	290.5
1983	5	8	.0	2445462.5	22 24.422	- 8 11.73	22 26.173	- 8 1.53	1.350	1.406	12.16	18.18	71.53	42.89	1.6	292.0
1983	5	10	.0	2445464.5	22 31.179	- 7 52.74	22 32.926	- 7 42.41	1.339	1.403	12.01	18.16	71.79	43.14	1.3	293.4
1983	5	12	.0	2445466.5	22 37.926	- 7 33.67	22 39.668	- 7 23.22	1.328	1.399	11.86	18.15	72.05	43.39	1.0	294.8
1983	5	14	.0	2445468.5	22 44.658	- 7 14.57	22 46.397	- 7 4.01	1.318	1.396	11.70	18.13	72.32	43.62	.6	296.3
1983	5	16	.0	2445470.5	22 51.374	- 6 55.47	22 53.109	- 6 44.81	1.307	1.393	11.54	18.12	72.58	43.83	.3	297.7
1983	5	18	.0	2445472.5	22 58.070	- 6 36.41	22 59.802	- 6 25.66	1.298	1.390	11.39	18.10	72.85	44.04	-.0	299.2
1983	5	20	.0	2445474.5	23 4.744	- 6 17.44	23 6.473	- 6 6.60	1.288	1.388	11.23	18.09	73.13	44.23	-.3	300.6
1983	5	22	.0	2445476.5	23 11.394	- 5 58.58	23 13.120	- 5 47.67	1.279	1.386	11.08	18.08	73.41	44.42	-.6	302.1
1983	5	24	.0	2445478.5	23 18.017	- 5 39.87	23 19.740	- 5 28.90	1.270	1.384	10.94	18.06	73.69	44.58	-1.0	303.5
1983	5	26	.0	2445480.5	23 24.610	- 5 21.35	23 26.331	- 5 10.32	1.262	1.383	10.82	18.05	73.98	44.74	-1.3	305.0
1983	5	28	.0	2445482.5	23 31.171	- 5 3.05	23 32.890	- 4 51.98	1.254	1.382	10.72	18.04	74.28	44.88	-1.6	306.5
1983	5	30	.0	2445484.5	23 37.697	- 4 45.02	23 39.414	- 4 33.91	1.246	1.382	10.65	18.03	74.59	45.01	-1.9	308.0
1983	6	1	.0	2445486.5	23 44.185	- 4 27.28	23 45.900	- 4 16.14	1.239	1.381	10.61	18.02	74.91	45.13	-2.3	309.4
1983	6	3	.0	2445488.5	23 50.632	- 4 9.87	23 52.345	- 3 58.72	1.231	1.381	10.39	18.01	75.24	45.23	-2.6	310.9
1983	6	5	.0	2445490.5	23 57.034	- 3 52.84	23 58.746	- 3 41.68	1.224	1.382	10.36	18.00	75.58	45.32	-2.9	312.4
1983	6	7	.0	2445492.5	0 3.388	- 3 36.22	0 5.100	- 3 25.05	1.218	1.383	10.33	17.99	75.93	45.40	-3.2	313.9
1983	6	9	.0	2445494.5	0 9.691	- 3 20.04	0 11.402	- 3 8.88	1.211	1.384	10.29	17.98	76.30	45.46	-3.5	315.3

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OF POOR QUALITY

YR	MN	DY	HR	J.D.	R.A. 1950.0	DEC.	R.A. DATE	DEC.	DELTA	R	TMAG	NMAG	THETA	BETA	LAT	LONG
1983	6	11	.0	2445496.5	0 15.940	- 3 4.34	0 17.650	- 2 53.20	1.205	1.385	10.25	17.98	76.68	45.50	-3.8	316.8
1983	6	13	.0	2445498.5	0 22.131	- 2 49.16	0 23.841	- 2 38.04	1.199	1.387	10.21	17.97	77.07	45.54	-4.1	318.3
1983	6	15	.0	2445500.5	0 28.262	- 2 34.52	0 29.971	- 2 23.44	1.193	1.389	10.16	17.96	77.48	45.55	-4.4	319.7
1983	6	17	.0	2445502.5	0 34.328	- 2 20.45	0 36.038	- 2 9.41	1.187	1.391	10.12	17.96	77.91	45.56	-4.7	321.2
1983	6	19	.0	2445504.5	0 40.329	- 2 6.99	0 42.039	- 1 55.99	1.182	1.394	10.08	17.95	78.35	45.54	-5.0	322.7
1983	6	21	.0	2445506.5	0 46.261	- 1 54.14	0 47.971	- 1 43.20	1.176	1.397	10.05	17.94	78.81	45.52	-5.3	324.1
1983	6	23	.0	2445508.5	0 52.123	- 1 41.94	0 53.833	- 1 31.05	1.171	1.401	10.03	17.94	79.28	45.48	-5.6	325.6
1983	6	25	.0	2445510.5	0 57.910	- 1 30.40	0 59.621	- 1 19.58	1.166	1.404	10.01	17.93	79.78	45.42	-5.9	327.0
1983	6	27	.0	2445512.5	1 3.622	- 1 19.54	1 5.332	- 1 8.79	1.161	1.408	10.01	17.93	80.29	45.35	-6.2	328.5
1983	6	29	.0	2445514.5	1 9.254	- 1 9.38	1 10.965	- 0 58.72	1.156	1.413	10.01	17.92	80.82	45.27	-6.4	329.9
1983	7	1	.0	2445516.5	1 14.804	- 0 59.95	1 16.516	- 0 49.37	1.152	1.417	10.03	17.92	81.38	45.17	-6.7	331.3
1983	7	3	.0	2445518.5	1 20.268	- 0 51.26	1 21.981	- 0 40.77	1.147	1.422	10.05	17.91	81.95	45.06	-7.0	332.7
1983	7	5	.0	2445520.5	1 25.644	- 0 43.34	1 27.358	- 0 32.93	1.142	1.427	10.08	17.91	82.55	44.93	-7.2	334.1
1983	7	7	.0	2445522.5	1 30.929	- 0 36.19	1 32.643	- 0 25.88	1.138	1.433	10.11	17.91	83.17	44.79	-7.5	335.5
1983	7	9	.0	2445524.5	1 36.118	- 0 29.84	1 37.833	- 0 19.63	1.133	1.439	10.15	17.90	83.82	44.63	-7.7	336.9
1983	7	11	.0	2445526.5	1 41.209	- 0 24.30	1 42.925	- 0 14.19	1.129	1.445	10.19	17.90	84.48	44.46	-7.9	338.3
1983	7	13	.0	2445528.5	1 46.199	- 0 19.57	1 47.915	- 0 9.57	1.125	1.451	10.22	17.89	85.18	44.27	-8.2	339.7
1983	7	15	.0	2445530.5	1 51.084	- 0 15.68	1 52.801	- 0 5.79	1.120	1.458	10.26	17.89	85.39	44.07	-8.4	341.0
1983	7	17	.0	2445532.5	1 55.863	- 0 12.61	1 57.580	- 0 2.83	1.116	1.465	10.30	17.88	86.63	43.85	-8.6	342.4
1983	7	19	.0	2445534.5	2 .533	- 0 10.37	2 2.250	- 0 .70	1.112	1.472	10.34	17.88	87.40	43.62	-8.8	343.7
1983	7	21	.0	2445536.5	2 5.091	- 0 8.97	2 6.809	+ 0 .59	1.107	1.479	10.38	17.87	88.20	43.37	-9.0	345.0
1983	7	23	.0	2445538.5	2 9.535	- 0 8.39	2 11.254	+ 0 1.05	1.103	1.487	10.41	17.87	89.02	43.10	-9.2	346.3
1983	7	25	.0	2445540.5	2 13.863	- 0 8.66	2 15.581	+ 0 .67	1.099	1.494	10.45	17.86	89.87	42.82	-9.4	347.6
1983	7	27	.0	2445542.5	2 18.070	- 0 9.75	2 19.789	- 0 .54	1.094	1.503	10.49	17.86	90.74	42.52	-9.6	348.9
1983	7	29	.0	2445544.5	2 22.156	- 0 11.68	2 23.874	- 0 2.58	1.090	1.511	10.53	17.85	91.65	42.21	-9.7	350.2
1983	7	31	.0	2445546.5	2 26.115	- 0 14.45	2 27.834	- 0 5.46	1.086	1.519	10.57	17.84	92.58	41.87	-9.9	351.5
1983	8	2	.0	2445548.5	2 29.945	- 0 18.05	2 31.664	- 0 9.17	1.081	1.528	10.62	17.84	93.55	41.52	-10.1	352.7
1983	8	4	.0	2445550.5	2 33.643	- 0 22.48	2 35.361	- 0 13.72	1.077	1.537	10.67	17.83	94.55	41.16	-10.2	354.0
1983	8	6	.0	2445552.5	2 37.204	- 0 27.74	2 38.921	- 0 19.09	1.072	1.546	10.73	17.82	95.57	40.77	-10.4	355.2
1983	8	8	.0	2445554.5	2 40.625	- 0 33.83	2 42.342	- 0 25.28	1.068	1.555	10.79	17.81	96.63	40.37	-10.5	356.4
1983	8	10	.0	2445556.5	2 43.903	- 0 40.73	2 45.619	- 0 32.28	1.063	1.565	10.85	17.80	97.72	39.94	-10.6	357.6
1983	8	12	.0	2445558.5	2 47.034	- 0 48.43	2 48.749	- 0 40.08	1.059	1.574	10.92	17.79	98.85	39.50	-10.8	358.8
1983	8	14	.0	2445560.5	2 50.016	- 0 56.91	2 51.730	- 0 48.66	1.054	1.584	10.98	17.79	100.01	39.03	-10.9	359.9
1983	8	16	.0	2445562.5	2 52.846	- 1 6.15	2 54.559	- 0 57.99	1.050	1.594	11.05	17.78	101.20	38.55	-11.0	1.1
1983	8	18	.0	2445564.5	2 55.522	- 1 16.13	2 57.233	- [illegible] 8.06	1.046	1.604	11.12	17.76	102.42	38.04	-11.1	2.2
1983	8	20	.0	2445566.5	2 58.040	- 1 26.83	2 59.750	- 1 18.85	1.041	1.615	11.18	17.75	103.68	37.52	-11.2	3.4
1983	8	22	.0	2445568.5	3 .399	- 1 38.23	3 2.107	- 1 30.33	1.037	1.625	11.24	17.74	104.97	36.97	-11.3	4.5
1983	8	24	.0	2445570.5	3 2.595	- 1 50.30	3 4.302	- 1 42.48	1.033	1.636	11.29	17.73	106.30	36.40	-11.4	5.6
1983	8	26	.0	2445572.5	3 4.625	- 2 3.02	3 6.330	- 1 55.27	1.029	1.646	11.34	17.72	107.66	35.80	-11.5	6.7
1983	8	28	.0	2445574.5	3 6.487	- 2 16.37	3 8.190	- 2 8.68	1.024	1.657	11.38	17.70	109.06	35.19	-11.6	7.7
1983	8	30	.0	2445576.5	3 8.176	- 2 30.31	3 9.877	- 2 22.68	1.020	1.668	11.42	17.69	110.49	34.55	-11.7	8.8
1983	9	1	.0	2445578.5	3 9.692	- 2 44.81	3 11.390	- 2 37.24	1.016	1.679	11.45	17.68	111.96	33.88	-11.8	9.8
1983	9	3	.0	2445580.5	3 11.029	- 2 59.84	3 12.725	- 2 52.31	1.013	1.690	11.49	17.66	113.47	33.20	-11.8	10.9
1983	9	5	.0	2445582.5	3 12.186	- 3 15.36	3 13.880	- 3 7.87	1.009	1.702	11.53	17.65	115.01	32.48	-11.9	11.9
1983	9	7	.0	2445584.5	3 13.161	- 3 31.31	3 14.853	- 3 23.86	1.006	1.713	11.57	17.63	116.58	31.75	-12.0	12.9
1983	9	9	.0	2445586.5	3 13.952	- 3 47.65	3 15.641	- 3 40.22	1.003	1.725	11.62	17.62	118.19	30.99	-12.0	13.9
1983	9	11	.0	2445588.5	3 14.559	- 4 4.31	3 16.246	- 3 56.90	1.000	1.736	11.69	17.60	119.83	30.21	-12.1	14.9
1983	9	13	.0	2445590.5	3 14.982	- 4 21.22	3 16.666	- 4 13.83	.997	1.748	11.77	17.59	121.50	29.40	-12.1	15.8
1983	9	15	.0	2445592.5	3 15.222	- 4 38.32	3 16.903	- 4 30.94	.995	1.760	11.87	17.57	123.19	28.58	-12.2	16.8
1983	9	17	.0	2445594.5	3 15.279	- 4 55.55	3 16.957	- 4 48.17	.993	1.771	12.00	17.56	124.92	27.73	-12.2	17.7
1983	9	19	.0	2445596.5	3 15.155	- 5 12.83	3 16.831	- 5 5.44	.991	1.783	12.15	17.54	126.67	26.86	-12.2	18.7
1983	9	21	.0	2445598.5	3 14.852	- 5 30.08	3 16.526	- 5 22.68	.990	1.795	[illegible]	17.53	128.45	25.98	-12.3	19.6
1983	9	23	.0	2445600.5	3 14.373	- 5 47.24	3 16.044	- 5 39.82	.989	1.807	12.54	17.51	130.24	25.08	-12.3	20.5
1983	9	25	.0	2445602.5	3 13.722	- 6 4.22	3 15.390	- 5 56.77	.988	1.820	12.77	17.50	132.05	24.16	-12.3	21.4
1983	9	27	.0	2445604.5	3 12.901	- 6 20.94	3 14.567	- 6 13.46	.988	1.832	13.03	17.49	133.87	23.24	-12.4	22.3
1983	9	29	.0	2445606.5	3 11.915	- 6 37.32	3 13.579	- 6 29.81	.989	1.844	13.31	17.47	135.69	22.30	-12.4	23.2
1983	10	1	.0	2445608.5	3 10.770	- 6 53.27	3 12.432	- 6 45.72	.990	1.856	13.60	17.46	137.52	21.36	-12.4	24.0

YR	MN	DY	HR	J.D.	R.A. 1950.0	DEC.	R.A. DATE	DEC.	DELTA	R	TMAG	NMAG	THETA	BETA	LAT	LONG
1983	10	3	.0	2445610.5	3 9.473	- 7 8.71	3 11.133	- 7 1.10	.992	1.869	13.90	17.45	139.34	20.42	-12.4	24.9
1983	10	5	.0	2445612.5	3 8.032	- 7 23.53	3 9.690	- 7 15.87	.995	1.881	.00	17.44	141.14	19.49	-12.4	25.7
1983	10	7	.0	2445614.5	3 6.455	- 7 37.64	3 8.111	- 7 29.92	.998	1.894	.00	17.44	142.92	18.56	-12.4	26.5
1983	10	9	.0	2445616.5	3 4.753	- 7 50.95	3 6.408	- 7 43.18	1.001	1.906	.00	17.43	144.66	17.65	-12.4	27.4
1983	10	11	.0	2445618.5	3 2.938	- 8 3.38	3 4.592	- 7 55.53	1.006	1.919	.00	17.43	146.36	1[illegible].76	-12.4	28.2
1983	10	13	.0	2445620.5	3 1.022	- 8 14.83	3 2.676	- 8 6.92	1.011	1.931	.00	17.43	147.99	15.90	-12.4	29.0
1983	10	15	.0	2445622.5	2 59.018	- 8 25.24	3 .671	- 8 17.25	1.017	1.944	.00	17.43	149.53	15.08	-12.4	29.7
1983	10	17	.0	2445624.5	2 56.939	- 8 34.54	2 58.592	- 8 26.48	1.024	1.956	.00	17.44	150.98	14.31	-12.4	30.5
1983	10	19	.0	2445626.5	2 54.798	- 8 42.67	2 56.450	- 8 34.54	1.032	1.969	.00	17.45	152.30	13.60	-12.4	31.3
1983	10	21	.0	2445628.5	2 52.609	- 8 49.60	2 54.261	- 8 41.39	1.040	1.982	.00	17.46	153.48	12.96	-12.4	32.0
1983	10	23	.0	2445630.5	2 50.384	- 8 55.26	2 52.037	- 8 46.98	1.050	1.994	.00	17.48	154.49	12.41	-12.4	32.8
1983	10	25	.0	2445632.5	2 48.138	- 8 59.65	2 49.791	- 8 51.29	1.060	2.007	.00	17.50	155.31	11.95	-12.4	33.5
1983	10	27	.0	2445634.5	2 45.883	- 9 2.73	2 47.537	- 8 54.30	1.071	2.020	.00	17.52	155.91	11.59	-12.4	34.2
1983	10	29	.0	2445636.5	2 43.633	- 9 4.50	2 45.287	- 8 55.99	1.084	2.033	.00	17.55	156.28	11.34	-12.4	35.0
1983	10	31	.0	2445638.5	2 41.399	- 9 4.94	2 43.055	- 8 56.35	1.097	2.046	.00	17.59	156.42	11.20	-12.4	35.7
1983	11	2	.0	2445640.5	2 39.196	- 9 4.05	2 40.853	- 8 55.39	1.111	2.058	.00	17.63	156.31	11.17	-12.3	36.4
1983	11	4	.0	2445642.5	2 37.035	- 9 1.84	2 38.693	- 8 53.11	1.126	2.071	.00	17.68	155.96	11.25	-12.3	37.1
1983	11	6	.0	2445644.5	2 34.929	- 8 58.33	2 36.588	- 8 49.53	1.141	2.084	.00	17.72	155.39	11.43	-12.3	37.7
1983	11	8	.0	2445646.5	2 32.887	- 8 53.53	2 34.549	- 8 44.68	1.158	2.097	.00	17.78	154.62	11.69	-12.3	38.4
1983	11	10	.0	2445648.5	2 30.921	- 8 47.50	2 32.585	- 8 38.58	1.176	2.110	.00	17.83	153.66	12.02	-12.3	39.1
1983	11	12	.0	2445650.5	2 29.039	- 8 40.26	2 30.705	- 8 31.28	1.194	2.122	.00	17.89	152.55	12.42	-12.2	39.7
1983	11	14	.0	2445652.5	2 27.249	- 8 31.86	2 28.917	- 8 22.83	1.214	2.135	.00	17.95	151.30	12.86	-12.2	40.4
1983	11	16	.0	2445654.5	2 25.557	- 8 22.37	2 27.227	- 8 13.29	1.234	2.148	.00	18.02	149.95	13.33	-12.2	41.0
1983	11	18	.0	2445656.5	2 23.969	- 8 11.83	2 25.641	- 8 2.70	1.255	2.161	.00	18.08	148.50	13.83	-12.2	41.7
1983	11	20	.0	2445658.5	2 22.489	- 8 .30	2 24.163	- 7 51.12	1.278	2.174	.00	18.15	146.98	14.34	-12.1	42.3
1983	11	22	.0	2445660.5	2 21.120	- 7 47.84	2 22.796	- 7 38.62	1.300	2.187	.00	18.22	145.40	14.86	-12.1	42.9
1983	11	24	.0	2445662.5	2 19.865	- 7 34.51	2 21.544	- 7 25.26	1.324	2.199	.00	18.28	143.77	15.38	-12.1	43.5
1983	11	26	.0	2445664.5	2 18.726	- 7 20.37	2 20.408	- 7 11.08	1.349	2.212	.00	18.35	142.11	15.90	-12.0	44.1
1983	11	28	.0	2445666.5	2 17.705	- 7 5.47	2 19.389	- 6 56.15	1.374	2.225	.00	18.42	140.42	16.41	-12.0	44.7
1983	11	30	.0	2445668.5	2 16.802	- 6 49.86	2 18.489	- 6 40.52	1.400	2.238	.00	18.49	138.71	16.91	-12.0	45.3
1983	12	2	.0	2445670.5	2 16.019	- 6 33.60	2 17.709	- 6 24.23	1.427	2.251	.00	18.56	136.98	17.39	-11.9	45.9
1983	12	4	.0	2445672.5	2 15.356	- 6 16.72	2 17.048	- 6 7.34	1.454	2.263	.00	18.62	135.25	17.85	-11.9	46.5
1983	12	6	.0	2445674.5	2 14.812	- 5 59.30	2 16.506	- 5 49.89	1.483	2.276	.00	18.69	133.51	18.30	-11.9	47.1
1983	12	8	.0	2445676.5	2 14.386	- 5 41.36	2 16.083	- 5 31.94	1.512	2.289	.00	18.76	131.77	18.72	-11.8	47.6
1983	12	10	.0	2445678.5	2 14.077	- 5 22.97	2 15.777	- 5 13.54	1.541	2.302	.00	18.82	130.04	19.12	-11.8	48.2
1983	12	12	.0	2445680.5	2 13.883	- 5 4.16	2 15.585	- 4 54.73	1.571	2.314	.00	18.89	128.31	19.50	-11.7	48.7
1983	12	14	.0	2445682.5	2 13.801	- 4 44.99	2 15.506	- 4 35.55	1.602	2.327	.00	18.95	126.58	19.86	-11.7	49.3
1983	12	16	.0	2445684.5	2 13.829	- 4 25.49	2 15.537	- 4 16.05	1.633	2.340	.00	19.02	124.87	20.19	-11.7	49.8
1983	12	18	.0	2445686.5	2 13.965	- 4 5.71	2 15.675	- 3 56.27	1.665	2.352	.00	19.08	123.16	20.50	-11.6	50.3
1983	12	20	.0	2445688.5	2 14.204	- 3 45.68	2 15.917	- 3 36.24	1.698	2.365	.00	19.14	121.47	20.78	-11.6	50.9
1983	12	22	.0	2445690.5	2 14.544	- 3 25.43	2 16.26[illegible]	- 3 16.01	1.730	2.378	.00	19.20	119.78	21.04	-11.5	51.4
1983	12	24	.0	2445692.5	2 14.982	- 3 5.00	2 16.700	- 2 55.59	1.764	2.390	.00	19.26	118.11	21.28	-11.5	51.9
1983	12	26	.0	2445694.5	2 15.515	- 2 44.42	2 17.236	- 2 35.02	1.798	2.403	.00	19.32	116.44	21.50	-11.5	52.4
1983	12	28	.0	2445696.5	2 16.140	- 2 23.70	2 17.864	- 2 14.32	1.832	2.415	.00	19.38	114.79	21.69	-11.4	52.9
1983	12	30	.0	2445698.5	2 16.855	- 2 2.88	2 18.581	- 1 53.52	1.867	2.428	.00	19.44	113.15	21.86	-11.4	53.4
1984	1	1	.0	2445700.5	2 17.657	- 1 41.97	2 19.386	- 1 32.63	1.902	2.440	.00	19.49	111.52	22.01	-11.3	53.9
1984	1	3	.0	2445702.5	2 18.543	- 1 21.00	2 20.275	- 1 11.68	1.937	2.453	.00	19.55	109.91	22.14	-11.3	54.4
1984	1	5	.0	2445704.5	2 19.511	- 0 59.98	2 21.246	- 0 50.69	1.973	2.[illegible]65	.00	19.60	108.31	22.25	-11.2	54.9
1984	1	7	.0	2445706.5	2 20.558	- 0 38.94	2 22.296	- 0 29.67	2.009	2.478	.00	19.66	106.72	22.34	-11.2	55.4
1984	1	9	.0	2445708.5	2 21.681	- 0 17.89	2 23.422	- 0 8.66	2.045	2.490	.00	19.71	105.14	22.41	-11.1	55.8
1984	1	11	.0	2445710.5	2 22.877	+ 0 3.14	2 24.621	+ 0 12.34	2.082	2.502	.00	19.76	103.57	22.46	-11.1	56.3
1984	1	13	.0	2445712.5	2 24.143	+ 0 24.14	2 25.890	+ 0 33.30	2.119	2.515	.00	19.81	102.02	22.49	-11.1	56.8
1984	1	15	.0	24457[illegible]4.5	2 25.477	+ 0 45.09	2 27.227	+ 0 54.22	2.156	2.527	.00	19.86	100.47	22.50	-11.0	57.2
1984	1	17	.0	2445716.5	2 26.875	+ 1 5.98	2 28.629	+ 1 15.07	2.193	2.539	.00	19.90	98.94	22.50	-11.0	57.7
1984	1	19	.0	2445718.5	2 28.336	+ 1 26.80	2 30.092	+ 1 35.84	2.231	2.552	.00	19.95	97.42	22.48	-10.9	58.1
1984	1	21	.0	2445720.5	2 29.856	+ 1 47.52	2 31.615	+ 1 56.53	2.268	2.564	.00	20.00	95.91	22.44	-10.9	58.6
1984	1	23	.0	2445722.5	2 31.433	+ 2 8.16	2 33.196	+ 2 17.11	2.306	2.576	.00	20.04	94.41	22.39	-10.8	59.0

YR	MO	DY	HR	J.D.	R.A. 1950.0	DEC.	R.A. DATE	DEC.	DELTA	R	TMAG	NMAG	THETA	BETA	LAT	LONG
1984	1	25	.0	2445724.5	2 33.065	+ 2 28.68	2 34.832	+ 2 37.59	2.344	2.588	.00	20.08	92.92	22.32	-10.8	59.5
1984	1	27	.0	2445726.5	2 34.751	+ 2 49.09	2 36.521	+ 2 57.95	2.382	[illegible]	.00	20.13	91.44	[illegible]	-10.7	59.9
1984	1	29	.0	2445728.5	2 36.489	+ 3 9.38	2 38.262	+ 3 18.19	2.420	2.612	.00	20.17	89.97	22.15	-10.7	60.3
1984	1	31	.0	2445730.5	2 38.277	+ 3 29.54	2 40.053	+ 3 38.29	2.459	2.625	.00	20.21	88.50	22.04	-10.6	60.7
1984	2	2	.0	2445732.5	2 40.112	+ 3 49.57	2 41.892	+ 3 58.26	2.497	2.637	.00	20.25	87.05	21.92	-10.6	61.2
1984	2	4	.0	2445734.5	2 41.994	+ 4 9.45	2 43.777	+ 4 18.08	2.535	2.649	.00	20.29	85.60	21.78	-10.5	61.6
1984	2	6	.0	2445736.5	2 43.920	+ 4 29.17	2 45.707	+ 4 37.74	2.573	2.661	.00	20.33	84.17	21.63	-10.5	62.0
1984	2	8	.0	2445738.5	2 45.889	+ 4 48.73	2 47.679	+ 4 57.24	2.612	2.672	.00	20.36	82.74	21.48	-10.5	62.4
1984	2	10	.0	2445740.5	2 47.898	+ 5 8.12	2 49.692	+ 5 16.56	2.650	2.684	.00	20.40	81.32	21.31	-10.4	62.8
1984	2	12	.0	2445742.5	2 49.946	+ 5 27.34	2 51.743	+ 5 35.71	2.688	2.696	.00	20.43	79.91	21.12	-10.4	63.2
1984	2	14	.0	2445744.5	2 52.031	+ 5 46.37	2 53.832	+ 5 54.67	2.726	2.708	.00	20.47	78.50	20.93	-10.3	63.6
1984	2	16	.0	2445746.5	2 54.152	+ 6 5.21	2 55.957	+ 6 13.44	2.764	2.720	.00	20.50	77.11	20.73	-10.3	64.0
1984	2	18	.0	2445748.5	2 56.307	+ 6 23.86	2 58.115	+ 6 32.02	2.802	2.732	.00	20.54	75.72	20.52	-10.2	64.4
1984	2	20	.0	2445750.5	2 58.494	+ 6 42.31	3 .307	+ 6 50.39	2.840	2.743	.00	20.57	74.33	20.30	-10.2	64.8
1984	2	22	.0	2445752.5	3 .713	+ 7 .55	3 2.529	+ 7 8.56	2.878	2.755	.00	20.60	72.96	20.07	-10.1	65.2
1984	2	24	.0	2445754.5	3 2.963	+ 7 18.60	3 4.783	+ 7 26.52	2.915	2.767	.00	20.63	71.59	19.84	-10.1	65.5
1984	2	26	.0	2445756.5	3 5.242	+ 7 36.43	3 7.065	+ 7 44.28	2.953	2.778	.00	20.66	70.22	19.59	-10.0	65.9
1984	2	28	.0	2445758.5	3 7.549	+ 7 54.05	3 9.377	+ 8 1.82	2.990	2.790	.00	20.69	68.87	19.34	-10.0	66.3
1984	3	1	.0	2445760.5	3 9.884	+ 8 11.46	3 11.715	+ 8 19.14	3.027	2.802	.00	20.71	67.51	19.08	-9.9	66.7
1984	3	3	.0	2445762.5	3 12.244	+ 8 28.65	3 14.080	+ 8 36.24	3.064	2.813	.00	20.74	66.17	18.81	-9.9	67.0
1984	3	5	.0	2445764.5	3 14.630	+ 8 45.61	3 16.470	+ 8 53.12	3.100	2.825	.00	20.77	64.83	18.53	-9.8	67.4
1984	3	7	.0	2445766.5	3 17.040	+ 9 2.35	3 18.884	+ 9 9.76	3.136	2.836	.00	20.79	63.49	18.25	-9.8	67.8
1984	3	9	.0	2445768.5	3 19.473	+ 9 18.85	3 21.321	+ 9 26.17	3.172	2.847	.00	20.82	62.16	17.96	-9.7	68.1
1984	3	11	.0	2445770.5	3 21.928	+ 9 35.12	3 23.779	+ 9 42.35	3.208	2.859	.00	20.84	60.83	17.67	-9.7	68.5
1984	3	13	.0	2445772.5	3 24.403	+ 9 51.15	3 26.258	+ 9 58.28	3.244	2.870	.00	20.87	59.52	17.36	-9.6	68.8
1984	3	15	.0	2445774.5	3 26.897	+10 6.93	3 28.757	+10 13.97	3.279	2.881	.00	20.89	58.20	17.06	-9.6	69.2
1984	3	17	.0	2445776.5	3 29.410	+10 22.47	3 31.274	+10 29.42	3.314	2.893	.00	20.91	56.89	16.75	-9.5	69.5
1984	3	19	.0	2445778.5	3 31.941	+10 37.77	3 33.809	+10 44.61	3.348	2.904	.00	20.93	55.59	16.43	-9.5	69.9
1984	3	21	.0	2445780.5	3 34.489	+10 52.82	3 36.360	+10 59.56	3.382	2.915	.00	20.95	54.28	16.11	-9.4	70.2
1984	3	23	.0	2445782.5	3 37.053	+11 7.61	3 38.928	+11 14.25	3.416	2.926	.00	20.97	52.99	15.78	-9.4	70.5
1984	3	25	.0	2445784.5	3 39.633	+11 22.16	3 41.512	+11 28.70	3.450	2.937	.00	20.99	51.69	15.45	-9.3	70.9
1984	3	27	.0	2445786.5	3 42.227	+11 36.46	3 44.111	+11 42.89	3.483	2.949	.00	21.01	50.40	15.12	-9.3	71.2
1984	3	29	.0	2445788.5	3 44.837	+11 50.50	3 46.725	+11 56.83	3.515	2.960	.00	21.03	49.12	14.78	-9.3	71.5
1984	3	31	.0	2445790.5	3 47.460	+12 4.29	3 49.352	+12 10.50	3.547	2.971	.00	21.05	47.84	14.44	-9.2	71.9
1984	4	2	.0	2445792.5	3 50.096	+12 17.82	3 51.992	+12 23.93	3.579	2.982	.00	21.06	46.56	14.09	-9.2	72.2
1984	4	4	.0	2445794.5	3 52.744	+12 31.09	3 54.644	+12 37.09	3.611	2.993	.00	21.08	45.28	13.74	-9.1	72.5
1984	4	6	.0	2445796.5	3 55.403	+12 44.10	3 57.307	+12 49.98	3.642	3.003	.00	21.10	44.01	13.39	-9.1	72.8
1984	4	8	.0	2445798.5	3 58.073	+12 56.85	3 59.480	+13 2.62	3.672	3.014	.00	21.11	42.74	13.03	-9.0	73.2
1984	4	10	.0	2445800.5	4 .752	+13 9.33	4 2.664	+13 14.98	3.702	3.025	.00	21.13	41.48	12.67	-9.0	73.5
1984	4	12	.0	2445802.5	4 3.440	+13 21.55	4 5.355	+13 27.08	3.732	3.036	.00	21.14	40.22	12.31	-8.9	73.8
1984	4	14	.0	2445804.5	4 6.136	+13 33.49	4 8.055	+13 38.91	3.761	3.047	.00	21.15	38.96	11.95	-8.9	74.1
1984	4	16	.0	2445806.5	4 8.840	+13 45.17	4 10.763	+13 50.47	3.789	3.057	.00	21.17	37.70	11.58	-8.8	74.4
1984	4	18	.0	2445808.5	4 11.550	+13 56.59	4 13.477	+14 1.77	3.817	3.068	.00	21.18	36.45	11.21	-8.8	74.7
1984	4	20	.0	2445810.5	4 14.268	+14 7.73	4 16.198	+14 12.79	3.845	3.079	.00	21.19	35.20	10.84	-8.7	75.0
1984	4	22	.0	2445812.5	4 16.991	+14 18.62	4 18.925	+14 23.55	3.872	3.089	.00	21.20	33.96	10.47	-8.7	75.3
1984	4	24	.0	2445814.5	4 19.720	+14 29.23	4 21.657	+14 34.04	3.898	3.100	.00	21.21	32.71	10.10	-8.6	75.6
1984	4	26	.0	2445816.5	4 22.453	+14 39.58	4 24.394	+14 44.26	3.924	3.110	.00	21.22	31.47	9.73	-8.6	75.9
1984	4	28	.0	24458.8.5	4 25.192	+14 49.65	4 27.136	+14 54.22	3.949	3.121	.00	21.23	30.24	9.35	-8.5	76.2
1984	4	30	.0	2445820.5	4 27.934	+14 59.47	4 29.881	+15 3.90	3.974	3.131	.00	21.24	29.00	8.97	-8.5	76.5
1984	5	2	.0	2445822.5	4 30.679	+15 9.01	4 32.630	+15 13.32	3.998	3.142	.00	21.25	27.77	8.60	-8.5	76.8
1984	5	4	.0	2445824.5	4 33.427	+15 18.28	4 35.381	+15 22.47	4.022	3.152	.00	21.26	26.54	8.22	-8.4	77.1
1984	5	6	.0	2445826.5	4 36.176	+15 27.29	4 38.134	+15 31.35	4.045	3.162	.00	21.27	25.32	7.84	-8.4	77.4
1984	5	8	.0	2445828.5	4 38.927	+15 36.03	4 40.887	+15 39.96	4.067	3.173	.00	21.28	24.10	7.46	-8.3	77.7
1984	5	10	.0	2445830.5	4 41.677	+15 44.50	4 43.641	+15 48.29	4.089	3.183	.00	21.28	22.88	7.09	-8.3	78.0
1984	5	12	.0	2445832.5	4 44.428	+15 52.70	4 46.395	+15 56.37	4.110	3.193	.00	21.29	21.67	6.71	-8.2	78.2
1984	5	14	.0	2445834.5	4 47.178	+16 .63	4 49.147	+16 4.17	4.131	3.203	.00	21.30	20.46	6.33	-8.2	78.5
1984	5	16	.0	2445836.5	4 49.926	+16 8.30	4 51.899	+16 11.71	4.150	3.213	.00	21.30	19.27	5.96	-8.1	78.8

YR	MN	DY	HR	J.D.	R.A. 1950.0	DEC.	R.A. DATE	DEC.	DELTA	R	TMAG	NMAG	THETA	BETA	LAT	LONG
1984	5	18	.0	2445838.5	4 52.673	+16 15.71	4 54.648	+16 18.98	4.170	3.223	.00	21.31	18.07	5.59	-8.1	79.1
1984	5	20	.0	2445840.5	4 55.417	+16 22.85	4 57.396	+16 26.00	4.188	3.233	.00	21.32	16.89	5.22	-8.0	79.4
1984	5	22	.0	2445842.5	4 58.160	+16 29.73	5 .140	+16 32.75	4.206	3.243	.00	21.32	15.72	4.85	-8.0	79.6
1984	5	24	.0	2445844.5	5 .899	+16 36.36	5 2.882	+16 39.24	4.224	3.253	.00	21.32	14.56	4.49	-7.9	79.9
1984	5	26	.0	2445846.5	5 3.634	+16 42.72	5 5.620	+16 45.47	4.240	3.263	.00	21.33	13.41	4.13	-7.9	80.2
1984	5	28	.0	2445848.5	5 6.366	+16 48.83	5 8.354	+16 51.45	4.256	3.273	.00	21.33	12.29	3.78	-7.9	80.4
1984	5	30	.0	2445850.5	5 9.093	+16 54.69	5 11.083	+16 57.17	4.272	3.283	.00	21.34	11.19	3.44	-7.8	80.7
1984	6	1	.0	2445852.5	5 11.814	+17 .28	5 13.807	+17 2.63	4.286	3.293	.00	21.34	10.13	3.11	-7.8	81.0

EXPLANATION OF SYMBOLS

J.D.= JULIAN DATE
R.A. AND DEC.- 1950.0 ARE RIGHT ASCENSION AND DECLINATION REFERRED TO MEAN EQUATOR AND EQUINOX OF 1950.0
R.A. AND DEC.- DATE ARE RIGHT ASCENSION AND DECLINATION REFERRED TO MEAN EQUATOR AND EQUINOX OF DATE
DELTA= GEOCENTRIC DISTANCE OF OBJECT IN A.U.
R= HELIOCENTRIC DISTANCE OF OBJECT IN A.U.

TMAG=TOTAL MAGNITUDE, COMPUTED FROM EMPIRICAL EQUATION BASED UPON PAST OBSERVED BEHAVIOR
NMAG= NUCLEAR MAGNITUDE = 15.5 + 5.00*DLOG10(DELTA) + 5.00*DLOG10(R) + .03*BETA
NOTE: IN CASES WHERE TMAG AND/OR NMAG ARE NOT COMPUTED, THE CORRESPONDING COLUMN(S) ARE FILLED WITH ZEROES (0.0).

THETA= SUN-EARTH-OBJECT ANGLE IN DEGREES
BETA= SUN-OBJECT-EARTH ANGLE IN DEGREES
LAT AND LONG ARE HELIOCENTRIC ECLIPTIC LATITUDE AND LONGITUDE IN DEG., REFERRED TO 1950.0

THE FOLLOWING OSCULATING ORBITAL ELEMENTS ARE CONSISTENT WITH THE ABOVE EPHEMERIS

EPOCH	2445480.50000	1983	5	26.00000
PERIHELION PASSAGE	2445487.03719	1983	6	1.53719
PERIHELION DISTANCE IN AU	1.3814043			
ECCENTRICITY	.5448930			
ARG. OF PERIHELION	190.92200			
LONG. OF ASCENDING NODE	119.15793			
INCLINATION	12.43750			

ANGLES ARE IN DEGREES AND ARE REFERRED TO THE ECLIPTIC AND EQUINOX OF 1950.0

ORBIT AND EPHEMERIS COMPUTATIONS BY

DR. D.K. YEOMANS
JET PROPULSION LAB.
PASADENA, CALIF. 91103

FIN NIF

ORIGINAL PAGE IS
OF POOR QUALITY

EPHEMERIS (WITH PERTURBATIONS) FOR COMET TEMPEL-2

YR	MN	DY	HR	J.D.	R.A. 1950.0	DEC.	R.A. DATE	DEC.	DELTA	R	TMAG	NMAG	THETA	BETA	LAT	LONG
1988	2	29	.0	2447220.5	15 44.387	- 4 2.48	15 46.393	- 4 9.54	1.919	2.360	.00	19.50	103.81	24.05	12.4	210.2
1988	3	1	.0	2447221.5	15 45.428	- 3 59.81	15 47.433	- 4 6.83	1.901	2.354	.00	19.48	104.53	24.05	12.4	210.4
1988	3	2	.0	2447222.5	15 46.456	- 3 57.02	15 48.461	- 4 3.99	1.884	2.348	.00	19.45	105.24	24.03	12.4	210.7
1988	3	3	.0	2447223.5	15 47.471	- 3 54.09	15 49.476	- 4 1.01	1.866	2.341	.00	19.42	105.96	24.02	12.4	211.0
1988	3	4	.0	2447224.5	15 48.473	- 3 51.03	15 50.477	- 3 57.91	1.849	2.335	.00	19.40	106.68	24.00	12.4	211.2
1988	3	5	.0	2447225.5	15 49.460	- 3 47.84	15 51.464	- 3 54.67	1.831	2.329	.00	19.37	107.41	23.98	12.4	211.5
1988	3	6	.0	2447226.5	15 50.433	- 3 44.51	15 52.437	- 3 51.30	1.814	2.322	.00	19.34	108.13	23.95	12.4	211.8
1988	3	7	.0	2447227.5	15 51.392	- 3 41.05	15 53.395	- 3 47.79	1.796	2.316	.00	19.31	108.86	23.92	12.4	212.0
1988	3	8	.0	2447228.5	15 52.336	- 3 37.46	15 54.338	- 3 44.15	1.779	2.310	.00	19.29	109.59	23.88	12.4	212.3
1988	3	9	.0	2447229.5	15 53.264	- 3 33.73	15 55.266	- 3 40.38	1.762	2.303	.00	19.26	110.32	23.84	12.4	212.6
1988	3	10	.0	2447230.5	15 54.177	- 3 29.87	15 56.178	- 3 36.48	1.745	2.297	.00	19.23	111.05	23.80	12.4	212.9
1988	3	11	.0	2447231.5	15 55.073	- 3 25.87	15 57.074	- 3 32.44	1.728	2.291	.00	19.20	111.79	23.75	12.4	213.2
1988	3	12	.0	2447232.5	15 55.953	- 3 21.74	15 57.954	- 3 28.27	1.711	2.284	.00	19.17	112.53	23.69	12.4	213.4
1988	3	13	.0	2447233.5	15 56.816	- 3 17.48	15 58.816	- 3 23.97	1.694	2.278	.00	19.14	113.27	23.63	12.4	213.7
1988	3	14	.0	2447234.5	15 57.662	- 3 13.09	15 59.661	- 3 19.53	1.678	2.272	.00	19.11	114.01	23.57	12.4	214.0
1988	3	15	.0	2447235.5	15 58.489	- 3 8.56	16 .487	- 3 14.96	1.661	2.265	.00	19.08	114.75	23.50	12.4	214.3
1988	3	16	.0	2447236.5	15 59.299	- 3 3.90	16 1.296	- 3 10.26	1.644	2.259	.00	19.05	115.50	23.42	12.4	214.6
1988	3	17	.0	2447237.5	16 .089	- 2 59.11	16 2.086	- 3 5.44	1.628	2.253	.00	19.02	116.25	23.34	12.4	214.9
1988	3	18	.0	2447238.5	16 .861	- 2 54.19	16 2.856	- 3 .48	1.612	2.246	.00	18.99	117.00	23.26	12.4	215.2
1988	3	19	.0	2447239.5	16 1.612	- 2 49.14	16 3.607	- 2 55.40	1.596	2.240	.00	18.96	117.75	23.17	12.4	215.5
1988	3	20	.0	2447240.5	16 2.344	- 2 43.97	16 4.338	- 2 50.19	1.579	2.233	.00	18.93	118.51	23.07	12.4	215.7
1988	3	21	.0	2447241.5	16 3.056	- 2 38.67	16 5.049	- 2 44.85	1.563	2.227	.00	18.90	119.26	22.97	12.3	216.0
1988	3	22	.0	2447242.5	16 3.747	- 2 33.25	16 5.739	- 2 39.40	1.548	2.221	.00	18.87	120.02	22.86	12.3	216.3
1988	3	23	.0	2447243.5	16 4.417	- 2 27.70	16 6.408	- 2 33.82	1.532	2.214	.00	18.83	120.78	22.75	12.3	216.6
1988	3	24	.0	2447244.5	16 5.066	- 2 22.04	16 7.056	- 2 28.13	1.516	2.208	.00	18.80	121.55	22.64	12.3	216.9
1988	3	25	.0	2447245.5	16 5.693	- 2 16.26	16 7.682	- 2 22.32	1.501	2.201	.00	18.77	122.31	22.51	12.3	217.2
1988	3	26	.0	2447246.5	16 6.298	- 2 10.37	16 8.286	- 2 16.40	1.485	2.195	.00	18.74	123.08	22.39	12.3	217.6
1988	3	27	.0	2447247.5	16 6.880	- 2 4.36	16 8.867	- 2 10.36	1.470	2.189	.00	18.70	123.85	22.25	12.3	217.9
1988	3	28	.0	2447248.5	16 7.440	- 1 58.24	16 9.425	- 2 4.21	1.455	2.182	.00	18.67	124.62	22.11	12.3	218.2
1988	3	29	.0	2447249.5	16 7.976	- 1 52.01	16 9.960	- 1 57.95	1.440	2.176	.00	18.64	125.39	21.97	12.3	218.5
1988	3	30	.0	2447250.5	16 8.488	- 1 45.67	16 10.471	- 1 51.59	1.425	2.169	.00	18.60	126.16	21.82	12.3	218.8
1988	3	31	.0	2447251.5	16 8.977	- 1 39.23	16 10.958	- 1 45.13	1.410	2.163	.00	18.57	126.94	21.66	12.2	219.1
1988	4	1	.0	2447252.5	16 9.440	- 1 32.68	16 11.421	- 1 38.56	1.395	2.157	.00	18.54	127.71	21.50	12.2	219.4
1988	4	2	.0	2447253.5	16 9.879	- 1 26.04	16 11.858	- 1 31.90	1.381	2.150	.00	18.50	128.49	21.34	12.2	219.7
1988	4	3	.0	2447254.5	16 10.293	- 1 19.30	16 12.270	- 1 25.14	1.366	2.144	.00	18.47	129.27	21.17	12.2	220.1
1988	4	4	.0	2447255.5	16 10.680	- 1 12.47	16 12.657	- 1 18.28	1.352	2.137	.00	18.43	130.05	20.99	12.2	220.4
1988	4	5	.0	2447256.5	16 11.042	- 1 5.54	16 13.017	- 1 11.34	1.338	2.131	.00	18.40	130.83	20.81	12.2	220.7
1988	4	6	.0	2447257.5	16 11.376	- 0 58.53	16 13.350	- 1 4.32	1.324	2.125	.00	18.36	131.61	20.62	12.2	221.0
1988	4	7	.0	2447258.5	16 11.684	- 0 51.44	16 13.656	- 0 57.21	1.310	2.118	.00	18.33	132.40	20.43	12.2	221.4
1988	4	8	.0	2447259.5	16 11.963	- 0 44.26	16 13.934	- 0 50.02	1.296	2.112	.00	18.29	133.18	20.23	12.1	221.7
1988	4	9	.0	2447260.5	16 12.215	- 0 37.02	16 14.184	- 0 42.76	1.283	2.105	.00	18.26	133.96	20.03	12.1	222.0
1988	4	10	.0	2447261.5	16 12.438	- 0 29.70	16 14.406	- 0 35.43	1.269	2.099	.00	18.22	134.75	19.82	12.1	222.3
1988	4	11	.0	2447262.5	16 12.632	- 0 22.32	16 14.599	- 0 28.04	1.256	2.092	.00	18.19	135.53	19.60	12.1	222.7
1988	4	12	.0	2447263.5	16 12.797	- 0 14.87	16 14.762	- 0 20.59	1.243	2.086	.00	18.15	136.31	19.39	12.1	223.0
1988	4	13	.0	2447264.5	16 12.932	- 0 7.38	16 14.895	- 0 13.09	1.230	2.080	.00	18.11	137.09	19.16	12.1	223.4
1988	4	14	.0	2447265.5	16 13.037	+ 0 .16	16 14.998	- 0 5.54	1.217	2.073	.00	18.08	137.87	18.94	12.0	223.7
1988	4	15	.0	2447266.5	16 13.111	+ 0 7.75	16 15.071	+ 0 2.05	1.205	2.067	.00	18.04	138.65	18.71	12.0	224.0
1988	4	16	.0	2447267.5	16 13.155	+ 0 15.37	16 15.113	+ 0 9.67	1.192	2.061	.00	18.01	139.43	18.47	12.0	224.4
1988	4	17	.0	2447268.5	16 13.167	+ 0 23.01	16 15.125	+ 0 17.31	1.180	2.054	.00	17.97	140.20	18.23	12.0	224.7
1988	4	18	.0	2447269.5	16 13.149	+ 0 30.67	16 15.105	+ 0 24.97	1.168	2.048	.00	17.93	140.97	17.99	12.0	225.1
1988	4	19	.0	2447270.5	16 13.099	+ 0 38.34	16 15.053	+ 0 32.64	1.156	2.041	.00	17.90	141.74	17.74	11.9	225.4
1988	4	20	.0	2447271.5	16 13.018	+ 0 46.02	16 14.971	+ 0 40.31	1.144	2.035	.00	17.86	142.50	17.49	11.9	225.8
1988	4	21	.0	2447272.5	16 12.906	+ 0 53.69	16 14.857	+ 0 47.97	1.132	2.029	.00	17.82	143.25	17.24	11.9	226.1
1988	4	22	.0	2447273.5	16 12.761	+ 1 1.34	16 14.711	+ 0 55.62	1.121	2.022	.00	17.79	144.00	16.99	11.9	226.5

YR	MN	DY	HR	J.D.	R.A. 1950.0	DEC.	R.A. DATE	DEC.	DELTA	R	TMAG	NMAG	THETA	BETA	LAT	LONG
1988	4	23	.0	2447274.5	16 12.586	+ 1 8.97	16 14.533	+ 1 3.24	1.109	2.016	.00	17.75	144.74	16.74	11.9	226.9
1988	4	24	.0	2447275.5	16 12.378	+ 1 16.57	16 14.324	+ 1 10.83	1.098	2.009	.00	17.71	145.47	16.48	11.8	227.2
1988	4	25	.0	2447276.5	16 12.139	+ 1 24.13	16 14.083	+ 1 18.38	1.087	2.003	.00	17.68	146.20	16.23	11.8	227.6
1988	4	26	.0	2447277.5	16 11.868	+ 1 31.65	16 13.811	+ 1 25.88	1.077	1.997	.00	17.64	146.91	15.97	11.8	228.0
1988	4	27	.0	2447278.5	16 11.565	+ 1 39.10	16 13.507	+ 1 33.31	1.066	1.990	.00	17.61	147.61	15.72	11.8	228.3
1988	4	28	.0	2447279.5	16 11.231	+ 1 46.48	16 13.171	+ 1 40.68	1.056	1.984	.00	17.57	148.30	15.47	11.7	228.7
1988	4	29	.0	2447280.5	16 10.865	+ 1 53.79	16 12.804	+ 1 47.97	1.045	1.978	.00	17.53	148.97	15.22	11.7	229.1
1988	4	30	.0	2447281.5	16 10.468	+ 2 1.00	16 12.405	+ 1 55.16	1.035	1.971	.00	17.50	149.62	14.97	11.7	229.5
1988	5	1	.0	2447282.5	16 10.040	+ 2 8.12	16 11.976	+ 2 2.26	1.026	1.965	.00	17.46	150.26	14.73	11.7	229.8
1988	5	2	.0	2447283.5	16 9.580	+ 2 15.13	16 11.515	+ 2 9.24	1.016	1.959	.00	17.43	150.88	14.50	11.6	230.2
1988	5	3	.0	2447284.5	16 9.090	+ 2 22.01	16 11.023	+ 2 16.10	1.006	1.952	.00	17.39	151.48	14.27	11.6	230.6
1988	5	4	.0	2447285.5	16 8.570	+ 2 28.77	16 10.502	+ 2 22.83	.997	1.946	.00	17.36	152.05	14.05	11.6	231.0
1988	5	5	.0	2447286.5	16 8.019	+ 2 35.38	16 9.950	+ 2 29.42	.988	1.940	.00	17.33	152.60	13.85	11.5	231.4
1988	5	6	.0	2447287.5	16 7.438	+ 2 41.84	16 9.368	+ 2 35.84	.979	1.934	.00	17.30	153.12	13.65	11.5	231.8
1988	5	7	.0	2447288.5	16 6.828	+ 2 48.13	16 8.757	+ 2 42.10	.970	1.927	.00	17.26	153.60	13.46	11.5	232.2
1988	5	8	.0	2447289.5	16 6.189	+ 2 54.23	16 8.116	+ 2 48.18	.962	1.921	.00	17.23	154.06	13.29	11.4	232.5
1988	5	9	.0	2447290.5	16 5.522	+ 3 .15	16 7.448	+ 2 54.06	.954	1.915	.00	17.20	154.48	13.13	11.4	232.9
1988	5	10	.0	2447291.5	16 4.827	+ 3 5.86	16 6.752	+ 2 59.74	.945	1.908	.00	17.17	154.86	12.99	11.4	233.3
1988	5	11	.0	2447292.5	16 4.105	+ 3 11.35	16 6.029	+ 3 5.19	.937	1.902	.00	17.14	155.21	12.87	11.3	233.8
1988	5	12	.0	2447293.5	16 3.356	+ 3 16.61	16 5.279	+ 3 10.41	.930	1.896	.00	17.11	155.51	12.76	11.3	234.2
1988	5	13	.0	2447294.5	16 2.582	+ 3 21.62	16 4.505	+ 3 15.38	.922	1.890	.00	17.09	155.76	12.68	11.3	234.6
1988	5	14	.0	2447295.5	16 1.784	+ 3 26.37	16 3.706	+ 3 20.09	.915	1.884	.00	17.06	155.97	12.62	11.2	235.0
1988	5	15	.0	2447296.5	16 .963	+ 3 30.84	16 2.883	+ 3 24.53	.908	1.877	.00	17.03	156.13	12.59	11.2	235.4
1988	5	16	.0	2447297.5	16 .119	+ 3 35.03	16 2.039	+ 3 28.67	.901	1.871	.00	17.01	156.24	12.57	11.1	235.8
1988	5	17	.0	2447298.5	15 59.255	+ 3 38.92	16 1.174	+ 3 32.52	.894	1.865	.00	16.99	156.31	12.59	11.1	236.2
1988	5	18	.0	2447299.5	15 58.371	+ 3 42.49	16 .289	+ 3 36.05	.887	1.859	.00	16.97	156.31	12.63	11.1	236.6
1988	5	19	.0	2447300.5	15 57.468	+ 3 45.74	15 59.386	+ 3 39.25	.881	1.853	.00	16.94	156.27	12.70	11.0	237.1
1988	5	20	.0	2447301.5	15 56.549	+ 3 48.65	15 58.467	+ 3 42.12	.875	1.846	.00	16.93	156.18	12.79	11.0	237.5
1988	5	21	.0	2447302.5	15 55.614	+ 3 51.21	15 57.532	+ 3 44.63	.869	1.840	.00	16.91	156.03	12.91	10.9	237.9
1988	5	22	.0	2447303.5	15 54.665	+ 3 53.41	15 56.583	+ 3 46.78	.863	1.834	.00	16.89	155.83	13.06	10.9	238.4
1988	5	23	.0	2447304.5	15 53.704	+ 3 55.23	15 55.621	+ 3 48.57	.858	1.828	.00	16.87	155.59	13.23	10.8	238.8
1988	5	24	.0	2447305.5	15 52.731	+ 3 56.68	15 54.649	+ 3 49.96	.852	1.822	.00	16.86	155.29	13.44	10.8	239.2
1988	5	25	.0	2447306.5	15 51.750	+ 3 57.74	15 53.667	+ 3 50.97	.847	1.816	.00	16.84	154.95	13.66	10.7	239.7
1988	5	26	.0	2447307.5	15 50.760	+ 3 58.39	15 52.678	+ 3 51.58	.842	1.810	.00	16.83	154.56	13.91	10.7	240.1
1988	5	27	.0	2447308.5	15 49.764	+ 3 58.64	15 51.682	+ 3 51.78	.837	1.804	.00	16.82	154.13	14.19	10.7	240.6
1988	5	28	.0	2447309.5	15 48.764	+ 3 58.47	15 50.682	+ 3 51.56	.833	1.798	.00	16.81	153.67	14.48	10.6	241.0
1988	5	29	.0	2447310.5	15 47.760	+ 3 57.87	15 49.679	+ 3 50.92	.828	1.792	.00	16.80	153.16	14.80	10.5	241.5
1988	5	30	.0	2447311.5	15 46.756	+ 3 56.84	15 48.675	+ 3 49.84	.824	1.786	.00	16.79	152.62	15.13	10.5	241.9
1988	5	31	.0	2447312.5	15 45.751	+ 3 55.38	15 47.671	+ 3 48.33	.820	1.780	.00	16.78	152.04	15.49	10.4	242.4
1988	6	1	.0	2447313.5	15 44.749	+ 3 53.47	15 46.669	+ 3 46.37	.816	1.77[illegible]	.00	16.78	151.44	15.86	10.4	242.8
1988	6	2	.0	2447314.5	15 43.750	+ 3 51.11	15 45.671	+ 3 43.97	.812	1.768	.00	16.77	150.80	16.25	10.3	243.3
1988	6	3	.0	2447315.5	15 42.757	+ 3 48.30	15 44.679	+ 3 41.11	.808	1.762	.00	16.77	150.14	16.65	10.3	243.8
1988	6	4	.0	2447316.5	15 41.771	+ 3 45.03	15 43.694	+ 3 37.79	.805	1.756	.00	16.76	149.46	17.07	10.2	244.2
1988	6	5	.0	2447317.5	15 40.793	+ 3 41.29	15 42.717	+ 3 34.01	.802	1.750	.00	16.76	148.76	17.50	10.2	244.7
1988	6	6	.0	2447318.5	15 39.826	+ 3 37.09	15 41.751	+ 3 29.76	.799	1.745	.00	16.76	148.03	17.94	10.1	245.2
1988	6	7	.0	2447319.5	15 38.871	+ 3 32.41	15 40.797	+ 3 25.04	.796	1.739	.00	16.76	147.29	18.39	10.0	245.7
1988	6	8	.0	2447320.5	15 37.930	+ 3 27.27	15 39.858	+ 3 19.85	.793	1.733	.00	16.76	146.53	18.85	10.0	246.1
1988	6	9	.0	2447321.5	15 37.005	+ 3 21.65	15 38.934	+ 3 14.19	.791	1.727	.00	16.76	145.76	19.31	9.9	246.6
1988	6	10	.0	2447322.5	15 36.097	+ 3 15.55	15 38.028	+ 3 8.05	.788	1.721	.00	16.76	144.97	19.79	9.9	247.1
1988	6	11	.0	2447323.5	15 35.209	+ 3 8.97	15 37.141	+ 3 1.43	.786	1.716	.00	16.76	144.18	20.27	9.8	247.6
1988	6	12	.0	2447324.5	15 34.342	+ 3 1.92	15 36.275	+ 2 54.34	.784	1.710	.00	16.76	143.37	20.75	9.7	248.1
1988	6	13	.0	2447325.5	15 33.497	+ 2 54.39	15 35.433	+ 2 46.77	.782	1.704	.00	16.76	142.56	21.24	9.7	248.6
1988	6	14	.0	2447326.5	15 32.678	+ 2 46.38	15 34.615	+ 2 38.73	.780	1.699	.00	16.76	141.74	21.73	9.6	249.1
1988	6	15	.0	2447327.5	15 31.884	+ 2 37.91	15 33.823	+ 2 30.22	.779	1.693	.00	16.77	140.91	22.23	9.5	249.6
1988	6	16	.0	2447328.5	15 31.118	+ 2 28.96	15 33.059	+ 2 21.24	.777	1.687	.00	16.77	140.08	22.73	9.4	250.1
1988	6	17	.0	2447329.5	15 30.381	+ 2 19.56	15 32.324	+ 2 11.80	.776	1.682	.00	16.77	139.25	23.23	9.4	250.6
1988	6	18	.0	2447330.5	15 29.675	+ 2 9.69	15 31.621	+ 2 1.90	.775	1.676	.00	16.78	138.42	23.72	9.3	251.1

YR	MO	DY	HR	J.D.	R.A. 1950.0	DEC.	R.A. DATE	DEC.	DELTA	R	TMAG	NMAG	THETA	BETA	LAT	LONG
1988	6	19	.0	2447331.5	15 29.001	+ 1 59.36	15 30.949	+ 1 51.54	.773	1.671	.00	16.78	137.58	24.22	9.2	251.6
1988	6	20	.0	2447332.5	15 28.361	+ 1 48.59	15 30.311	+ 1 40.74	.773	1.665	.00	16.79	136.74	24.72	9.2	252.2
1988	6	21	.0	2447333.5	15 27.755	+ 1 37.38	15 29.708	+ 1 29.50	.772	1.660	.00	16.79	135.91	25.22	9.1	252.7
1988	6	22	.0	2447334.5	15 27.185	+ 1 25.73	15 29.140	+ 1 17.82	.771	1.654	.00	16.80	135.07	25.71	9.0	253.2
1988	6	23	.0	2447335.5	15 26.652	+ 1 13.65	15 28.609	+ 1 5.72	.770	1.649	.00	16.81	134.24	26.21	8.9	253.7
1988	6	24	.0	2447336.5	15 26.157	+ 1 1.15	15 28.117	+ 0 53.20	.770	1.644	.00	16.81	133.40	26.70	8.8	254.3
1988	6	25	.0	2447337.5	15 25.701	+ 0 48.24	15 27.663	+ 0 40.27	.770	1.638	.00	16.82	132.58	27.19	8.8	254.8
1988	6	26	.0	2447338.5	15 25.284	+ 0 34.92	15 27.249	+ 0 26.93	.769	1.633	.00	16.83	131.75	27.67	8.7	255.3
1988	6	27	.0	2447339.5	15 24.908	+ 0 21.21	15 26.876	+ 0 13.20	.769	1.628	.00	16.83	130.93	28.15	8.6	255.9
1988	6	28	.0	2447340.5	15 24.573	+ 0 7.11	15 26.544	- 0 .91	.769	1.622	.00	16.84	130.11	28.63	8.5	256.4
1988	6	29	.0	2447341.5	15 24.280	- 0 7.37	15 26.254	- 0 15.41	.769	1.617	.00	16.85	129.30	29.11	8.4	257.0
1988	6	30	.0	2447342.5	15 24.029	- 0 22.23	15 26.007	- 0 30.27	.769	1.612	.00	16.85	128.50	29.57	8.3	257.5
1988	7	1	.0	2447343.5	15 23.822	- 0 37.44	15 25.802	- 0 45.50	.769	1.607	.00	16.86	127.70	30.04	8.2	258.1
1988	7	2	.0	2447344.5	15 23.658	- 0 53.01	15 25.642	- 1 1.08	.770	1.602	.00	16.87	126.90	30.50	8.1	258.6
1988	7	3	.0	2447345.5	15 23.539	- 1 8.93	15 25.525	- 1 17.00	.770	1.597	.00	16.88	126.11	30.95	8.1	259.2
1988	7	4	.0	2447346.5	15 23.464	- 1 25.18	15 25.454	- 1 33.25	.771	1.592	.00	16.89	125.33	31.40	8.0	259.8
1988	7	5	.0	2447347.5	15 23.434	- 1 41.76	15 25.427	- 1 49.84	.771	1.587	.00	16.89	124.56	31.85	7.9	260.3
1988	7	6	.0	2447348.5	15 23.450	- 1 58.67	15 25.447	- 2 6.74	.772	1.582	.00	16.90	123.79	32.29	7.8	260.9
1988	7	7	.0	2447349.5	15 23.512	- 2 15.89	15 25.512	- 2 23.96	.773	1.577	.00	16.91	123.03	32.72	7.7	261.5
1988	7	8	.0	2447350.5	15 23.621	- 2 33.41	15 25.625	- 2 41.48	.774	1.572	.00	16.92	122.28	33.14	7.6	262.1
1988	7	9	.0	2447351.5	15 23.776	- 2 51.23	15 25.784	- 2 59.29	.774	1.567	.00	16.93	121.53	33.56	7.5	262.6
1988	7	10	.0	2447352.5	15 23.979	- 3 9.34	15 25.991	- 3 17.39	.775	1.563	.00	16.94	120.79	33.98	7.4	263.2
1988	7	11	.0	2447353.5	15 24.230	- 3 27.72	15 26.245	- 3 35.77	.776	1.558	.00	16.95	120.06	34.39	7.3	263.8
1988	7	12	.0	2447354.5	15 24.529	- 3 46.38	15 26.548	- 3 54.41	.778	1.553	.00	16.95	119.34	34.79	7.2	264.4
1988	7	13	.0	2447355.5	15 24.876	- 4 5.30	15 26.898	- 4 13.31	.779	1.549	.00	16.96	118.63	35.18	7.0	265.0
1988	7	14	.0	2447356.5	15 25.271	- 4 24.47	15 27.298	- 4 32.47	.780	1.544	.00	16.97	117.93	35.57	6.9	265.6
1988	7	15	.0	2447357.5	15 25.715	- 4 43.88	15 27.746	- 4 51.86	.781	1.540	.00	16.98	117.23	35.95	6.8	266.2
1988	7	16	.0	2447358.5	15 26.208	- 5 3.52	15 28.243	- 5 11.48	.783	1.535	13.95	16.99	116.54	36.32	6.7	266.8
1988	7	17	.0	2447359.5	15 26.750	- 5 23.38	15 28.789	- 5 31.32	.784	1.531	13.90	17.00	115.87	36.69	6.6	267.4
1988	7	18	.0	2447360.5	15 27.341	- 5 43.46	15 29.384	- 5 51.37	.786	1.526	13.85	17.01	115.20	37.05	6.5	268.0
1988	7	19	.0	2447361.5	15 27.980	- 6 3.75	15 30.028	- 6 11.63	.787	1.522	13.79	17.01	114.54	37.40	6.4	268.6
1988	7	20	.0	2447362.5	15 28.669	- 6 24.22	15 30.721	- 6 32.07	.789	1.518	13.74	17.02	113.89	37.75	6.3	269.2
1988	7	21	.0	2447363.5	15 29.406	- 6 44.89	15 31.462	- 6 52.70	.790	1.514	13.68	17.03	113.25	38.08	6.1	269.9
1988	7	22	.0	2447364.5	15 30.192	- 7 5.72	15 32.253	- 7 13.51	.792	1.509	13.62	17.04	112.62	38.42	6.0	270.5
1988	7	23	.0	2447365.5	15 31.027	- 7 26.73	15 33.092	- 7 34.48	.794	1.505	13.57	17.05	111.99	38.74	5.9	271.1
1988	7	24	.0	2447366.5	15 31.910	- 7 47.89	15 33.980	- 7 55.60	.795	1.501	13.51	17.06	111.38	39.06	5.8	271.7
1988	7	25	.0	2447367.5	15 32.841	- 8 9.20	15 34.916	- 8 16.87	.797	1.497	13.44	17.07	110.77	39.37	5.7	272.4
1988	7	26	.0	2447368.5	15 33.821	- 8 30.65	15 35.901	- 8 38.27	.799	1.493	13.38	17.07	110.18	39.67	5.5	273.0
1988	7	27	.0	2447369.5	15 34.848	- 8 52.23	15 36.933	- 8 59.81	.801	1.489	13.31	17.08	109.59	39.97	5.4	273.6
1988	7	28	.0	2447370.5	15 35.923	- 9 13.93	15 38.013	- 9 21.46	.803	1.486	13.25	17.09	109.01	40.26	5.3	274.3
1988	7	29	.0	2447371.5	15 37.046	- 9 35.74	15 39.141	- 9 43.22	.805	1.482	13.17	17.10	108.44	40.54	5.2	274.9
1988	7	30	.0	2447372.5	15 38.216	- 9 57.66	15 40.317	-10 5.08	.807	1.478	13.10	17.11	107.88	40.82	5.0	275.6
1988	7	31	.0	2447373.5	15 39.434	-10 19.67	15 41.539	-10 27.03	.809	1.474	13.02	17.12	107.33	41.09	4.9	276.2
1988	8	1	.0	2447374.5	15 40.698	-10 41.76	15 42.809	-10 49.07	.811	1.471	12.94	17.12	106.79	41.35	4.8	276.9
1988	8	2	.0	2447375.5	15 42.010	-11 3.94	15 44.126	-11 11.19	.813	1.467	12.86	17.13	106.25	41.60	4.6	277.5
1988	8	3	.0	2447376.5	15 43.369	-11 26.18	15 45.490	-11 33.37	.815	1.464	12.78	17.14	105.73	41.85	4.5	278.2
1988	8	4	.0	2447377.5	15 44.774	-11 48.49	15 46.901	-11 55.61	.818	1.460	12.69	17.15	105.21	42.10	4.4	278.9
1988	8	5	.0	2447378.5	15 46.226	-12 10.85	15 48.359	-12 17.91	.820	1.457	12.60	17.16	104.70	42.33	4.2	279.5
1988	8	6	.0	2447379.5	15 47.725	-12 33.26	15 49.864	-12 40.24	.822	1.454	12.52	17.16	104.20	42.56	4.1	280.2
1988	8	7	.0	2447380.5	15 49.271	-12 55.70	15 51.416	-13 2.61	.824	1.451	12.43	17.17	103.71	42.78	3.9	280.9
1988	8	8	.0	2447381.5	15 50.864	-13 18.17	15 53.015	-13 25.01	.827	1.447	12.34	17.18	103.22	43.00	3.8	281.5
1988	8	9	.0	2447382.5	15 52.503	-13 40.66	15 54.660	-13 47.41	.829	1.444	12.25	17.19	102.75	43.21	3.7	282.2
1988	8	10	.0	2447383.5	15 54.189	-14 3.15	15 56.352	-14 9.83	.832	1.441	12.17	17.20	102.28	43.41	3.5	282.9
1988	8	11	.0	2447384.5	15 55.922	-14 25.65	15 58.091	-14 32.24	.834	1.438	12.09	17.20	101.82	43.60	3.4	283.6
1988	8	12	.0	2447385.5	15 57.701	-14 48.13	15 59.876	-14 54.64	.837	1.436	12.00	17.21	101.37	43.79	3.2	284.3
1988	8	13	.0	2447386.5	15 59.526	-15 10.60	16 1.707	-15 17.02	.839	1.433	11.92	17.22	100.92	43.97	3.1	284.9
1988	8	14	.0	2447387.5	16 1.397	-15 33.04	16 3.585	-15 39.36	.842	1.430	11.85	17.23	100.49	44.15	2.9	285.6

YR	MO	DY	HR	J.D.	R.A. 1950.0	DEC.	R.A. DATE	DEC.	DELTA	R	TMAG	NMAG	THETA	BETA	LAT	LONG
1988	8	15	.0	2447388.5	16 3.315	-15 55.43	16 5.509	-16 1.67	.844	1.427	11.77	17.23	100.06	44.32	2.8	286.3
1988	8	16	.0	2447389.5	16 5.278	-16 17.78	16 7.479	-16 23.92	.847	1.425	11.70	17.24	99.64	44.48	2.6	287.0
1988	8	17	.0	2447390.5	16 7.287	-16 40.07	16 9.494	-16 46.11	.850	1.422	11.63	17.25	99.23	44.64	2.5	287.7
1988	8	18	.0	2447391.5	16 9.341	-17 2.29	16 11.555	-17 8.23	.852	1.420	11.57	17.26	98.83	44.79	2.3	288.4
1988	8	19	.0	2447392.5	16 11.441	-17 24.43	16 13.661	-17 30.26	.855	1.418	11.51	17.27	98.43	44.93	2.2	289.1
1988	8	20	.0	2447393.5	16 13.585	-17 46.48	16 15.812	-17 52.21	.858	1.415	11.44	17.27	98.04	45.07	2.0	289.8
1988	8	21	.0	2447394.5	16 15.775	-18 8.44	16 18.008	-18 14.05	.861	1.413	11.38	17.28	97.66	45.20	1.9	290.5
1988	8	22	.0	2447395.5	16 18.008	-18 30.28	16 20.249	-18 35.78	.864	1.411	11.33	17.29	97.28	45.32	1.7	291.2
1988	8	23	.0	2447396.5	16 20.286	-18 52.00	16 22.534	-18 57.38	.867	1.409	11.27	17.30	96.91	45.44	1.6	291.9
1988	8	24	.0	2447397.5	16 22.608	-19 13.59	16 24.862	-19 18.85	.870	1.407	11.21	17.30	96.55	45.55	1.4	292.6
1988	8	25	.0	2447398.5	16 24.973	-19 35.04	16 27.234	-19 40.18	.873	1.405	11.16	17.31	96.20	45.66	1.3	293.4
1988	8	26	.0	2447399.5	16 27.382	-19 56.34	16 29.650	-20 1.35	.876	1.403	11.10	17.32	95.85	45.76	1.1	294.1
1988	8	27	.0	2447400.5	16 29.833	-20 17.47	16 32.108	-20 22.36	.879	1.401	11.05	17.33	95.51	45.86	1.0	294.8
1988	8	28	.0	2447401.5	16 32.327	-20 38.44	16 34.609	-20 43.20	.882	1.400	10.99	17.34	95.18	45.95	.8	295.5
1988	8	29	.0	2447402.5	16 34.863	-20 59.22	16 37.153	-21 3.85	.885	1.398	10.94	17.34	94.85	46.03	.6	296.2
1988	8	30	.0	2447403.5	16 37.442	-21 19.81	16 39.738	-21 24.30	.889	1.397	10.88	17.35	94.53	46.11	.5	296.9
1988	8	31	.0	2447404.5	16 40.062	-21 40.19	16 42.366	-21 44.55	.892	1.395	10.82	17.36	94.21	46.18	.3	297.7
1988	9	1	.0	2447405.5	16 42.724	-22 .37	16 45.035	-22 4.58	.895	1.394	10.77	17.37	93.90	46.25	.2	298.4
1988	9	2	.0	2447406.5	16 45.428	-22 20.32	16 47.745	-22 24.38	.899	1.393	10.71	17.38	93.60	46.31	.0	299.1
1988	9	3	.0	2447407.5	16 48.172	-22 40.03	16 50.497	-22 43.95	.902	1.391	10.66	17.38	93.30	46.37	-.2	299.8
1988	9	4	.0	2447408.5	16 50.958	-22 59.50	16 53.289	-23 3.27	.906	1.390	10.60	17.39	93.01	46.42	-.3	300.6
1988	9	5	.0	2447409.5	16 53.784	-23 18.71	16 56.122	-23 22.33	.909	1.389	10.55	17.40	92.72	46.46	-.5	301.3
1988	9	6	.0	2447410.5	16 56.650	-23 37.66	16 58.995	-23 41.12	.913	1.388	10.50	17.41	92.44	46.50	-.6	302.0
1988	9	7	.0	2447411.5	16 59.556	-23 56.33	17 1.908	-23 59.64	.916	1.387	10.45	17.42	92.16	46.54	-.8	302.8
1988	9	8	.0	2447412.5	17 2.502	-24 14.72	17 4.861	-24 17.86	.920	1.387	10.40	17.43	91.89	46.56	-1.0	303.5
1988	9	9	.0	2447413.5	17 5.487	-24 32.80	17 7.852	-24 35.78	.924	1.386	10.36	17.43	91.62	46.59	-1.1	304.2
1988	9	10	.0	2447414.5	17 8.510	-24 50.58	17 10.882	-24 53.39	.928	1.385	10.32	17.44	91.36	46.61	-1.3	305.0
1988	9	11	.0	2447415.5	17 11.572	-25 8.04	17 13.950	-25 10.68	.932	1.385	10.29	17.45	91.11	46.62	-1.4	305.7
1988	9	12	.0	2447416.5	17 14.671	-25 25.16	17 17.055	-25 27.64	.936	1.384	10.26	17.46	90.86	46.63	-1.6	306.4
1988	9	13	.0	2447417.5	17 17.806	-25 41.95	17 20.197	-25 44.25	.940	1.384	10.24	17.47	90.61	46.63	-1.8	307.2
1988	9	14	.0	2447418.5	17 20.979	-25 58.39	17 23.376	-26 .51	.944	1.384	10.23	17.48	90.37	46.63	-1.9	307.9
1988	9	15	.0	2447419.5	17 24.187	-26 14.46	17 26.590	-26 16.41	.948	1.384	10.22	17.49	90.13	46.62	-2.1	308.6
1988	9	16	.0	2447420.5	17 27.430	-26 30.17	17 29.839	-26 31.93	.952	1.383	10.22	17.50	89.90	46.61	-2.2	309.4
1988	9	17	.0	2447421.5	17 30.707	-26 45.50	17 33.121	-26 47.08	.956	1.383	10.23	17.51	89.67	46.59	-2.4	310.1
1988	9	18	.0	2447422.5	17 34.017	-27 .43	17 36.437	-27 1.83	.961	1.383	9.80	17.52	89.44	46.57	-2.6	310.8
1988	9	19	.0	2447423.5	17 37.360	-27 14.97	17 39.786	-27 16.18	.965	1.384	9.80	17.52	89.22	46.54	-2.7	311.6
1988	9	20	.0	2447424.5	17 40.735	-27 29.10	17 43.166	-27 30.12	.970	1.384	9.81	17.53	89.01	46.51	-2.9	312.3
1988	9	21	.0	2447425.5	17 44.141	-27 42.82	17 46.576	-27 43.64	.974	1.384	9.81	17.54	88.79	46.48	-3.0	313.0
1988	9	22	.0	2447426.5	17 47.576	-27 56.11	17 50.016	-27 56.74	.979	1.385	9.81	17.55	88.58	46.44	-3.2	313.8
1988	9	23	.0	2447427.5	17 51.040	-28 8.97	17 53.485	-28 9.40	.984	1.385	9.81	17.56	88.38	46.39	-3.3	314.5
1988	9	24	.0	2447428.5	17 54.532	-28 21.39	17 56.982	-28 21.63	.988	1.386	9.81	17.57	88.17	46.35	-3.5	315.3
1988	9	25	.0	2447429.5	17 58.051	-28 33.36	18 .505	-28 33.40	.993	1.386	9.81	17.58	87.97	46.29	-3.7	316.0
1988	9	26	.0	2447430.5	18 1.596	-28 44.88	18 4.053	-28 44.72	.998	1.387	9.81	17.59	87.78	46.24	-3.8	316.7
1988	9	27	.0	2447431.5	18 5.165	-28 55.93	18 7.626	-28 55.57	1.003	1.388	9.80	17.60	87.58	46.18	-4.0	317.5
1988	9	28	.0	2447432.5	18 8.759	-29 6.52	18 11.223	-29 5.96	1.008	1.389	9.80	17.61	87.39	46.11	-4.1	318.2
1988	9	29	.0	2447433.5	18 12.375	-29 16.64	18 14.842	-29 15.87	1.014	1.390	9.80	17.63	87.20	46.05	-4.3	318.9
1988	9	30	.0	2447434.5	18 16.013	-29 26.27	18 18.483	-29 25.30	1.019	1.391	9.79	17.64	87.01	45.97	-4.4	319.7
1988	10	1	.0	2447435.5	18 19.672	-29 35.43	18 22.144	-29 34.25	1.024	1.392	9.79	17.65	86.83	45.90	-4.6	320.4
1988	10	2	.0	2447436.5	18 23.350	-29 44.09	18 25.825	-29 42.70	1.030	1.393	9.79	17.66	86.64	45.82	-4.7	321.1
1988	10	3	.0	2447437.5	18 27.047	-29 52.26	18 29.524	-29 50.66	1.035	1.394	9.79	17.67	86.46	45.73	-4.9	321.8
1988	10	4	.0	2447438.5	18 30.762	-29 59.93	18 33.241	-29 58.13	1.041	1.396	9.79	17.68	86.28	45.65	-5.0	322.6
1988	10	5	.0	2447439.5	18 34.493	-30 7.10	18 36.973	-30 5.09	1.046	1.397	9.80	17.69	86.10	45.56	-5.2	323.3
1988	10	6	.0	2447440.5	18 38.240	-30 13.76	18 40.721	-30 11.54	1.052	1.399	9.80	17.70	85.93	45.46	-5.3	324.0
1988	10	7	.0	2447441.5	18 42.000	-30 19.92	18 44.482	-30 17.49	1.058	1.401	9.81	17.71	85.75	45.37	-5.4	324.8
1988	10	8	.0	2447442.5	18 45.774	-30 25.56	18 48.256	-30 22.92	1.064	1.402	9.82	17.73	85.58	45.27	-5.6	325.5
1988	10	9	.0	2447443.5	18 49.559	-30 30.70	18 52.041	-30 27.85	1.070	1.404	9.83	17.74	85.41	45.16	-5.7	326.2
1988	10	10	.0	2447444.5	18 53.355	-30 35.32	18 55.837	-30 32.26	1.076	1.406	9.84	17.75	85.24	45.06	-5.9	326.9

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YR	MO	DY	HR	J.D.	R.A. 1950.0	DEC.	R.A. DATE	DEC.	DELTA	R	TMAG	NMAG	THETA	BETA	LAT	LONG
1988	10	11	.0	2447445.5	18 57.160	-30 39.42	18 59.642	-30 36.16	1.082	1.408	9.86	17.76	85.07	44.95	-6.0	327.6
1988	10	12	.0	2447446.5	19 .973	-30 43.01	19 3.454	-30 39.54	1.089	1.410	9.87	17.78	84.90	44.83	-6.1	328.4
1988	10	13	.0	2447447.5	19 4.793	-30 46.09	19 7.272	-30 42.41	1.095	1.412	9.89	17.79	84.73	44.72	-6.3	329.1
1988	10	14	.0	2447448.5	19 8.619	-30 48.65	19 11.096	-30 44.77	1.101	1.414	9.92	17.80	84.56	44.60	-6.4	329.8
1988	10	15	.0	2447449.5	19 12.448	-30 50.71	19 14.924	-30 46.61	1.108	1.416	9.94	17.81	84.39	44.47	-6.5	330.5
1988	10	16	.0	2447450.5	19 16.281	-30 52.25	19 18.754	-30 47.95	1.115	1.419	9.97	17.83	84.23	44.35	-6.7	331.2
1988	10	17	.0	2447451.5	19 20.115	-30 53.28	19 22.586	-30 48.77	1.122	1.421	9.99	17.84	84.06	44.22	-6.8	331.9
1988	10	18	.0	2447452.5	19 23.950	-30 53.80	19 26.418	-30 49.10	1.128	1.424	10.02	17.85	83.90	44.09	-6.9	332.6
1988	10	19	.0	2447453.5	19 27.783	-30 53.83	19 30.249	-30 48.92	1.135	1.426	10.05	17.87	83.73	43.96	-7.1	333.3
1988	10	20	.0	2447454.5	19 31.615	-30 53.35	19 34.077	-30 48.24	1.142	1.429	10.09	17.88	83.56	43.83	-7.2	334.0
1988	10	21	.0	2447455.5	19 35.443	-30 52.38	19 37.902	-30 47.07	1.150	1.431	10.12	17.89	83.40	43.69	-7.3	334.7
1988	10	22	.0	2447456.5	19 39.267	-30 50.92	19 41.722	-30 45.41	1.157	1.434	10.16	17.91	83.23	43.55	-7.4	335.4
1988	10	23	.0	2447457.5	19 43.085	-30 48.97	19 45.536	-30 43.27	1.164	1.437	10.19	17.92	83.06	43.41	-7.6	336.1
1988	10	24	.0	2447458.5	19 46.897	-30 46.54	19 49.342	-30 40.65	1.172	1.440	10.23	17.93	82.90	43.26	-7.7	336.8
1988	10	25	.0	2447459.5	19 50.700	-30 43.63	19 53.141	-30 37.55	1.179	1.443	10.27	17.95	82.73	43.12	-7.8	337.5
1988	10	26	.0	2447460.5	19 54.495	-30 40.26	19 56.931	-30 33.99	1.187	1.446	10.30	17.96	82.56	42.97	-7.9	338.2
1988	10	27	.0	2447461.5	19 58.279	-30 36.42	20 .711	-30 29.96	1.194	1.449	10.34	17.98	82.39	42.82	-8.0	338.9
1988	10	28	.0	2447462.5	20 2.053	-30 32.12	20 4.479	-30 25.48	1.202	1.452	10.38	17.99	82.22	42.67	-8.1	339.5
1988	10	29	.0	2447463.5	20 5.816	-30 27.37	20 8.236	-30 20.55	1.210	1.456	10.42	18.01	82.05	42.52	-8.2	340.2
1988	10	30	.0	2447464.5	20 9.566	-30 22.18	20 11.980	-30 15.17	1.218	1.459	10.45	18.02	81.87	42.36	-8.4	340.9
1988	10	31	.0	2447465.5	20 13.303	-30 16.55	20 15.711	-30 9.36	1.226	1.462	10.49	18.03	81.70	42.20	-8.5	341.6
1988	11	1	.0	2447466.5	20 17.025	-30 10.48	20 19.428	-30 3.13	1.235	1.466	10.53	18.05	81.52	42.05	-8.6	342.2
1988	11	2	.0	2447467.5	20 20.734	-30 4.00	20 23.130	-29 56.47	1.243	1.469	10.57	18.06	81.34	41.89	-8.7	342.9
1988	11	3	.0	2447468.5	20 24.426	-29 57.09	20 26.816	-29 49.39	1.251	1.473	10.60	18.08	81.17	41.72	-8.8	343.6
1988	11	4	.0	2447469.5	20 28.103	-29 49.78	20 30.486	-29 41.91	1.260	1.476	10.64	18.09	80.99	41.56	-8.9	344.2
1988	11	5	.0	2447470.5	20 31.763	-29 42.07	20 34.139	-29 34.04	1.269	1.480	10.68	18.11	80.80	41.40	-9.0	344.9
1988	11	6	.0	2447471.5	20 35.406	-29 33.96	20 37.775	-29 25.77	1.277	1.484	10.71	18.13	80.62	41.23	-9.1	345.6
1988	11	7	.0	2447472.5	20 39.031	-29 25.48	20 41.393	-29 17.13	1.286	1.488	10.75	18.14	80.43	41.06	-9.2	346.2
1988	11	8	.0	2447473.5	20 42.637	-29 16.61	20 44.993	-29 8.11	1.295	1.491	10.79	18.16	80.25	40.89	-9.3	346.9
1988	11	9	.0	2447474.5	20 46.225	-29 7.39	20 48.573	-28 58.73	1.304	1.495	10.83	18.17	80.06	40.72	-9.4	347.5
1988	11	10	.0	2447475.5	20 49.793	-28 57.80	20 52.135	-28 48.99	1.313	1.499	10.87	18.19	79.86	40.55	-9.5	348.2
1988	11	11	.0	2447476.5	20 53.342	-28 47.86	20 55.676	-28 38.91	1.323	1.503	10.90	18.20	79.67	40.38	-9.5	348.8
1988	11	12	.0	2447477.5	20 56.870	-28 37.59	20 59.197	-28 28.49	1.332	1.507	10.94	18.22	79.48	40.21	-9.6	349.4
1988	11	13	.0	2447478.5	21 .378	-28 26.98	21 2.697	-28 17.74	1.341	1.512	10.98	18.24	79.28	40.03	-9.7	350.1
1988	11	14	.0	2447479.5	21 3.864	-28 16.06	21 6.176	-28 6.68	1.351	1.516	11.03	18.25	79.08	39.86	-9.8	350.7
1988	11	15	.0	2447480.5	21 7.330	-28 4.82	21 9.634	-27 55.30	1.361	1.520	11.07	18.27	78.88	39.68	-9.9	351.3
1988	11	16	.0	2447481.5	21 10.773	-27 53.28	21 13.070	-27 43.63	1.370	1.524	11.11	18.28	78.67	39.50	-10.0	352.0
1988	11	17	.0	2447482.5	21 14.195	-27 41.44	21 16.484	-27 31.67	1.380	1.529	11.16	18.30	78.47	39.32	-10.0	352.6
1988	11	18	.0	2447483.5	21 17.594	-27 29.33	21 19.876	-27 19.42	1.390	1.533	11.20	18.32	78.26	39.14	-10.1	353.2
1988	11	19	.0	2447484.5	21 20.971	-27 16.94	21 23.246	-27 6.91	1.400	1.538	11.25	18.33	78.05	38.96	-10.2	353.8
1988	11	20	.0	2447485.5	21 24.325	-27 4.28	21 26.593	-26 54.13	1.410	1.542	11.29	18.35	77.83	38.78	-10.3	354.4
1988	11	21	.0	2447486.5	21 27.657	-26 51.36	21 29.917	-26 41.10	1.421	1.547	11.34	18.37	77.62	38.60	-10.3	355.0
1988	11	22	.0	2447487.5	21 30.965	-26 38.20	21 33.218	-26 27.83	1.431	1.551	11.39	18.38	77.40	38.41	-10.4	355.6
1988	11	23	.0	2447488.5	21 34.250	-26 24.80	21 36.496	-26 14.31	1.441	1.556	11.44	18.40	77.18	38.23	-10.5	356.2
1988	11	24	.0	2447489.5	21 37.513	-26 11.17	21 39.751	-26 .58	1.452	1.560	11.49	18.42	76.95	38.05	-10.6	356.8
1988	11	25	.0	2447490.5	21 40.752	-25 57.32	21 42.983	-25 46.62	1.462	1.565	11.55	18.43	76.73	37.86	-10.6	357.4
1988	11	26	.0	2447491.5	21 43.968	-25 43.26	21 46.192	-25 32.45	1.473	1.570	11.60	18.45	76.50	37.68	-10.7	358.0
1988	11	27	.0	2447492.5	21 47.161	-25 28.98	21 49.378	-25 18.08	1.484	1.575	11.65	18.47	76.26	37.49	-10.8	358.6
1988	11	28	.0	2447493.5	21 50.332	-25 14.51	21 52.541	-25 3.51	1.495	1.580	11.71	18.48	76.03	37.30	-10.8	359.2
1988	11	29	.0	2447494.5	21 53.479	-24 59.85	21 55.682	-24 48.75	1.506	1.585	11.76	18.50	75.79	37.11	-10.9	359.8
1988	11	30	.0	2447495.5	21 56.604	-24 45.01	21 58.800	-24 33.82	1.517	1.589	11.81	18.52	75.55	36.93	-10.9	.4
1988	12	1	.0	2447496.5	21 59.707	-24 29.99	22 1.896	-24 18.71	1.528	1.594	11.87	18.54	75.30	36.74	-11.0	.9
1988	12	2	.0	2447497.5	22 2.787	-24 14.81	22 4.969	-24 3.44	1.539	1.600	11.92	18.55	75.06	36.55	-11.1	1.5
1988	12	3	.0	2447498.5	22 5.845	-23 59.46	22 8.021	-23 48.01	1.551	1.605	11.97	18.57	74.81	36.36	-11.1	2.1
1988	12	4	.0	2447499.5	22 8.881	-23 43.96	22 11.050	-23 32.43	1.562	1.610	12.02	18.59	74.55	36.17	-11.2	2.7
1988	12	5	.0	2447500.5	22 11.895	-23 28.32	22 14.058	-23 16.71	1.573	1.615	12.08	18.60	74.30	35.98	-11.2	3.2
1988	12	6	.0	2447501.5	22 14.887	-23 12.53	22 17.044	-23 .85	1.585	1.620	12.13	18.62	74.04	35.79	-11.3	3.8

YR	MN	DY	HR	J.D.	R.A. 1950.0	DEC.	R.A. DATE	DEC.	DELTA	R	TMAG	NMAG	THETA	BETA	LAT	LONG
1988	12	7	.0	2447502.5	22 17.859	-22 56.62	22 20.009	-22 44.86	1.597	1.625	12.17	18.64	73.78	35.59	-11.3	4.3
1988	12	8	.0	2447503.5	22 20.808	-22 40.58	22 22.953	-22 28.75	.609	1.630	12.22	18.66	73.51	35.40	-11.4	4.9
1988	12	9	.0	2447504.5	22 23.737	-22 24.42	22 25.876	-22 12.52	.620	1.636	12.27	18.67	73.25	35.21	-11.4	5.4
1988	12	10	.0	2447505.5	22 26.645	-22 8.15	22 28.778	-21 56.18	1.632	1.641	12.31	18.69	72.98	35.02	-11.5	6.0
1988	12	11	.0	2447506.5	22 29.533	-21 51.78	22 31.659	-21 39.75	1.644	1.646	12.36	18.71	72.70	34.82	-11.5	6.5
1988	12	12	.0	2447507.5	22 32.400	-21 35.30	22 34.521	-21 23.21	1.656	1.652	12.40	18.72	72.43	34.63	-11.5	7.1
1988	12	13	.0	2447508.5	22 35.247	-21 18.74	22 37.362	-21 6.59	1.669	1.657	12.44	18.74	72.15	34.43	-11.6	7.6
1988	12	14	.0	2447509.5	22 38.074	-21 2.09	22 40.184	-20 49.88	1.681	1.663	12.48	18.76	71.87	34.24	-11.6	8.1
1988	12	15	.0	2447510.5	22 40.881	-20 45.36	22 42.986	-20 33.10	1.693	1.668	12.52	18.78	71.58	34.04	-11.7	8.7
1988	12	16	.0	2447511.5	22 43.668	-20 28.56	22 45.768	-20 16.24	1.706	1.674	12.56	18.79	71.29	33.85	-11.7	9.2
1988	12	17	.0	2447512.5	22 46.437	-20 11.69	22 48.531	-19 59.33	1.718	1.679	12.59	18.81	71.00	33.65	-11.7	9.7
1988	12	18	.0	2447513.5	22 49.186	-19 54.76	22 51.275	-19 42.35	1.731	1.685	12.63	18.83	70.71	33.45	-11.8	10.2
1988	12	19	.0	2447514.5	22 51.916	-19 37.78	22 54.000	-19 25.31	1.743	1.690	12.67	18.84	70.42	33.26	-11.8	10.7
1988	12	20	.0	2447515.5	22 54.627	-19 20.74	22 56.707	-19 8.23	1.756	1.696	12.71	18.86	70.12	33.06	-11.8	11.3
1988	12	21	.0	2447516.5	22 57.320	-19 3.66	22 59.395	-18 51.11	1.769	1.702	12.75	18.88	69.82	32.86	-11.9	11.8
1988	12	22	.0	2447517.5	22 59.995	-18 46.53	23 2.066	-18 33.94	1.781	1.707	12.79	18.90	69.51	32.66	-11.9	12.3
1988	12	23	.0	2447518.5	23 2.651	-18 29.37	23 4.718	-18 16.74	1.794	1.713	12.83	18.91	69.20	32.47	-11.9	12.8
1988	12	24	.0	2447519.5	23 5.290	-18 12.18	23 7.353	-17 59.51	1.807	1.719	12.87	18.93	68.89	32.27	-12.0	13.3
1988	12	25	.0	2447520.5	23 7.912	-17 54.96	23 9.971	-17 42.26	1.820	1.724	12.92	18.95	68.58	32.07	-12.0	13.8
1988	12	26	.0	2447521.5	23 10.517	-17 37.71	23 12.572	-17 24.98	1.833	1.730	12.97	18.96	68.27	31.87	-12.0	14.3
1988	12	27	.0	2447522.5	23 13.105	-17 20.45	23 15.156	-17 7.69	1.847	1.736	13.02	18.98	67.95	31.67	-12.1	14.7
1988	12	28	.0	2447523.5	23 15.676	-17 3.17	23 17.724	-16 50.38	1.860	1.742	13.08	19.00	67.62	31.47	-12.1	15.2
1988	12	29	.0	2447524.5	23 18.232	-16 45.88	23 20.275	-16 33.06	1.873	1.748	13.14	19.01	67.30	31.27	-12.1	15.7
1988	12	30	.0	2447525.5	23 20.771	-16 28.57	23 22.811	-16 15.73	1.886	1.753	13.21	19.03	66.97	31.07	-12.1	16.2
1988	12	31	.0	2447526.5	23 23.295	-16 11.27	23 25.332	-15 58.40	1.900	1.759	13.28	19.05	66.64	30.87	-12.1	16.7
1989	1	1	.0	2447527.5	23 25.804	-15 53.96	23 27.837	-15 41.07	1.913	1.765	13.35	19.06	66.31	30.67	-12.2	17.2
1989	1	2	.0	2447528.5	23 28.297	-15 36.65	23 30.328	-15 23.74	1.927	1.771	13.44	19.08	65.98	30.47	-12.2	17.6
1989	1	3	.0	2447529.5	23 30.776	-15 19.35	23 32.804	-15 6.42	1.940	1.777	13.53	19.10	65.64	30.27	-12.2	18.1
1989	1	4	.0	2447530.5	23 33.241	-15 2.06	23 35.265	-14 49.11	1.954	1.783	13.62	19.11	65.30	30.07	-12.2	18.6
1989	1	5	.0	2447531.5	23 35.691	-14 44.78	23 37.713	-14 31.82	1.968	1.789	13.72	19.13	64.95	29.87	-12.2	19.0
1989	1	6	.0	2447532.5	23 38.127	-14 27.51	23 40.146	-14 14.54	1.981	1.795	13.83	19.15	64.61	29.66	-12.3	19.5
1989	1	7	.0	2447533.5	23 40.550	-14 10.26	23 42.566	-13 57.27	1.995	1.801	13.95	19.16	64.26	29.46	-12.3	19.9
1989	1	8	.0	2447534.5	23 42.960	-13 53.04	23 44.973	-13 40.03	2.009	1.807	.00	19.18	63.91	29.26	-12.3	20.4
1989	1	9	.0	2447535.5	23 45.356	-13 35.83	23 47.367	-13 22.82	2.023	1.813	.00	19.19	63.55	29.05	-12.3	20.8
1989	1	10	.0	2447536.5	23 47.739	-13 18.65	23 49.748	-13 5.64	2.037	1.819	.00	19.21	63.20	28.85	-12.3	21.3
1989	1	11	.0	2447537.5	23 50.109	-13 1.51	23 52.116	-12 48.48	2.051	1.825	.00	19.23	62.84	28.65	-12.3	21.7
1989	1	12	.0	2447538.5	23 52.467	-12 44.39	23 54.472	-12 31.36	2.065	1.831	.00	19.24	62.48	28.44	-12.3	22.2
1989	1	13	.0	2447539.5	23 54.813	-12 27.31	23 56.816	-12 14.28	2.079	1.837	.00	19.26	62.12	28.24	-12.4	22.6
1989	1	14	.0	2447540.5	23 57.146	-12 10.27	23 59.148	-11 57.24	2.093	1.844	.00	19.27	61.75	28.03	-12.4	23.0
1989	1	15	.0	2447541.5	23 59.468	-11 53.28	0 1.467	-11 40.24	2.107	1.850	.00	19.29	61.38	27.83	-12.4	23.5
1989	1	16	.0	2447542.5	0 1.778	-11 36.32	0 3.776	-11 23.28	2.121	1.856	.00	19.30	61.01	27.62	-12.4	23.9
1989	1	17	.0	2447543.5	0 4.076	-11 19.41	0 6.072	-11 6.37	2.135	1.862	.00	19.32	60.64	27.42	-12.4	24.3
1989	1	18	.0	2447544.5	0 6.363	-11 2.55	0 8.357	-10 49.51	2.149	1.868	.00	19.33	60.27	27.21	-12.4	24.8
1989	1	19	.0	2447545.5	0 8.638	-10 45.74	0 10.632	-10 32.70	2.164	1.874	.00	19.35	59.89	27.01	-12.4	25.2
1989	1	20	.0	2447546.5	0 10.903	-10 28.98	0 12.895	-10 15.95	2.178	1.881	.00	19.37	59.51	26.80	-12.4	25.6
1989	1	21	.0	2447547.5	0 13.157	-10 12.27	0 15.148	- 9 59.25	2.192	1.887	.00	19.38	59.13	26.60	-12.4	26.0
1989	1	22	.0	2447548.5	0 15.400	- 9 55.62	0 17.390	- 9 42.60	2.206	1.893	.00	19.40	58.75	26.39	-12.4	26.4
1989	1	23	.0	2447549.5	0 17.633	- 9 39.02	0 19.622	- 9 26.02	2.221	1.899	.00	19.41	58.36	26.18	-12.4	26.8
1989	1	24	.0	2447550.5	0 19.856	- 9 22.48	0 21.844	- 9 9.49	2.235	1.905	.00	19.43	57.97	25.98	-12.4	27.2
1989	1	25	.0	2447551.5	0 22.069	- 9 6.01	0 24.056	- 8 53.02	2.249	1.912	.00	19.44	57.58	25.77	-12.4	27.6
1989	1	26	.0	2447552.5	0 24.272	- 8 49.59	0 26.259	- 8 36.62	2.264	1.918	.00	19.46	57.19	25.56	-12.4	28.0
1989	1	27	.0	2447553.5	0 26.466	- 8 33.24	0 28.452	- 8 20.28	2.278	1.924	.00	19.47	56.80	25.35	-12.4	28.4
1989	1	28	.0	2447554.5	0 28.650	- 8 16.95	0 30.636	- 8 4.00	2.293	1.930	.00	19.48	56.40	25.15	-12.4	28.8
1989	1	29	.0	2447555.5	0 30.826	- 8 .72	0 32.811	- 7 47.79	2.307	1.937	.00	19.50	56.00	24.94	-12.4	29.2
1989	1	30	.0	2447556.5	0 32.992	- 7 44.56	0 34.977	- 7 31.65	2.321	1.943	.00	19.51	55.60	24.73	-12.4	29.6
1989	1	31	.0	2447557.5	0 35.150	- 7 28.47	0 37.134	- 7 15.58	2.336	1.949	.00	19.53	55.20	24.52	-12.4	30.0
1989	2	1	.0	2447558.5	0 37.299	- 7 12.45	0 39.283	- 6 59.57	2.350	1.956	.00	19.54	54.80	24.31	-12.4	30.4

ORIGINAL PAGE IS
OF POOR QUALITY

YR	MN	DY	HR	J.D.	R.A. 1950.0	DEC.	R.A. DATE	DEC.	DELTA	R	THAG	NMAG	THETA	BETA	LAT	LONG
1989	2	2	.0	2447559.5	0 39.440	- 6 56.49	0 41.424	- 6 43.64	2.365	1.962	.00	19.56	54.39	24.10	-12.4	30.8
1989	2	3	.0	2447560.5	0 41.573	- 6 40.61	0 43.557	- 6 27.78	2.379	1.968	.00	19.57	53.98	23.89	-12.4	31.2
1989	2	4	.0	2447561.5	0 43.698	- 6 24.80	0 45.682	- 6 11.99	2.394	1.975	.00	19.58	53.57	23.68	-12.4	31.6
1989	2	5	.0	2447562.5	0 45.815	- 6 9.07	0 47.799	- 5 56.28	2.408	1.981	.00	19.60	53.16	23.47	-12.4	31.9
1989	2	6	.0	2447563.5	0 47.924	- 5 53.41	0 49.909	- 5 40.64	2.423	1.987	.00	19.61	52.75	23.26	-12.4	32.3
1989	2	7	.0	2447564.5	0 50.026	- 5 37.82	0 52.011	- 5 25.08	2.437	1.994	.00	19.62	52.33	23.05	-12.4	32.7
1989	2	8	.0	2447565.5	0 52.121	- 5 22.31	0 54.105	- 5 9.60	2.452	2.000	.00	19.64	51.91	22.84	-12.4	33.0
1989	2	9	.0	2447566.5	0 54.208	- 5 6.88	0 56.193	- 4 54.20	2.466	2.006	.00	19.65	51.50	22.63	-12.4	33.4
1989	2	10	.0	2447567.5	0 56.288	- 4 51.53	0 58.273	- 4 38.88	2.481	2.013	.00	19.66	51.07	22.42	-12.4	33.8
1989	2	11	.0	2447568.5	0 58.361	- 4 36.27	1 .347	- 4 23.64	2.495	2.019	.00	19.68	50.65	22.21	-12.4	34.1
1989	2	12	.0	2447569.5	1 .427	- 4 21.08	1 2.413	- 4 8.48	2.510	2.026	.00	19.69	50.23	22.00	-12.4	34.5

EXPLANATION OF SYMBOLS

J.D.= JULIAN DATE
R.A. AND DEC.- 1950.0 ARE RIGHT ASCENSION AND DECLINATION REFERRED TO MEAN EQUATOR AND EQUINOX OF 1950.0
R.A. AND DEC.- DATE ARE RIGHT ASCENSION AND DECLINATION REFERRED TO MEAN EQUATOR AND EQUINOX OF DATE
DELTA= GEOCENTRIC DISTANCE OF OBJECT IN A.U.
R= HELIOCENTRIC DISTANCE OF OBJECT IN A.U.

THAG=TOTAL MAGNITUDE, COMPUTED FROM EMPIRICAL EQUATION BASED UPON PAST OBSERVED BEHAVIOR
NMAG= NUCLEAR MAGNITUDE = 15.5 + 5.00*DLOG10(DELTA) + 5.00*DLOG10(R) + .03*BETA
NOTE: IN CASES WHERE TMAG AND/OR NMAG ARE NOT COMPUTED, THE CORRESPONDING COLUMN(S) ARE FILLED WITH ZEROES (0.0).

THETA= SUN-EARTH-OBJECT ANGLE IN DEGREES
BETA= SUN-OBJECT-EARTH ANGLE IN DEGREES
LAT AND LONG ARE HELIOCENTRIC ECLIPTIC LATITUDE AND LONGITUDE IN DEG., REFERRED TO 1950.0

THE FOLLOWING OSCULATING ORBITAL ELEMENTS ARE CONSISTENT WITH THE ABOVE EPHEMERIS

EPOCH	2447440.50000	1988	10	6.00000
PERIHELION PASSAGE	2447421.23687	1988	9	16.73687
PERIHELION DISTANCE IN AU	1.3834294			
ECCENTRICITY	.5444278			
ARG. OF PERIHELION	191.03860			
LONG. OF ASCENDING NODE	119.11816			
INCLINATION	12.43190			

ANGLES ARE IN DEGREES AND ARE REFERRED TO THE ECLIPTIC AND EQUINOX OF 1950.0

ORBIT AND EPHEMERIS COMPUTATIONS BY

DR. D.K. YEOMANS
JET PROPULSION LAB.
PASADENA, CALIF. 91103

*FIN

NIF*