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A CANDIDATE FOR THE PARENT BODY OF THE TAURID COMPLEX AND ITS SEARCH EPHEMERIS

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ABSTRACT

Untypical asteroid 5025 P-L, which its perihelion close to the orbit of Mercury and its aphelion between the orbits of Jupiter and Saturn, seems to be a good candidate for the parent body of the Taurid complex of small interplanetary objects. Evidences that this asteroid is a major source of meteoroids as well as an analysis of the orbits of asteroidal and cometary members of the Taurid complex presented in the paper, lead to conclusion that 5025 P-L might be regarded as a remnant of a giant comet which was a progenitor of the overall complex according to the hypothesis of Clube and Napier. Unfortunately, the orbit of 5025 P-L is very poorly determined because the computations were based upon only three positional observations over an arc of only four days in October 1960. Any further research on the problem of origin and evolution of the Taurid complex needs better determined orbit of this key asteroid. Therefore its new positions are necessary. In order to enable the search of eventual trails of 5025 P-L on plates which can be found in archives, its ephemeris for the opposition in 1960, when the asteroid passed about 0.5 AU from the Earth, is presented.

GENERAL REMARKS

Among the asteroidal members of the Taurid complex of small interplanetary bodies in high-eccentricity, low-inclination and short-period orbits, the minor planet 5025 P-L seems to be especially interesting because its orbit may be considered in some measure as a transitional one between orbits of the two cometary members of this complex. The membership of short period comet Encke in the Taurid complex is undisputable. There are also evidences that comet 1967 II Rudnicki belongs to the Taurid complex (Olson-Steel 1987, Ziołkowski 1988, 1990) although its long period orbit creates some difficulties in the understanding of this connection. According to the hypothesis of Clube and Napier (1984) the Taurid complex has originated from a giant comet which arrived in an Earth-crossing orbit and broke up some 10^4-10^5 years ago. Let us consider an object which moves along the orbit similar to the orbit of asteroid 5025 P-L. It is easy to show that the 2-3 percent changes of its velocity in perihelion can transfer this object on the orbit similar to the short-period orbit of comet Encke as well as to the long-period orbit of comet Rudnicki. In particular the decrease of the velocity of 5025 P-L by 1.4 km/s gives the orbit which shape is similar to the orbit of comet Encke and the increase by 1.7 km/s gives the orbit which shape is similar to the original orbit of comet Rudnicki. According to investigations of Clube and Napier (1984) those values of the velocity changes seem to be acceptable. This estimation, together with the evidence that asteroid 5025 P-L is a major source of meteoroids (Olson-Steel 1988), leads to the conclusion that this unusual object might be regarded as a remnant of a giant comet which was a progenitor of the overall Taurid

complex. Therefore any further researches on the problem of origin and evolution of the complex need a good knowledge of the motion of 5025 P-L. Unfortunately its orbit is very poorly determined because the computations were based upon only three positional observations made on October 22, 25 and 26, 1960 in the frame of the Palomar-Leiden Survey of faint minor planets (Van Houten et al. 1984). If the elements obtained by this way can be reliable, the object would have its perihelion close to the orbit of Mercury and its aphelion between the orbits of Jupiter and Saturn. It may be well to add that the orbit of such a body is dynamically unstable due its possibilities of approaches to the major planets. An absolute magnitude of the object was estimated as 16.9 mag. which indicates that it is likely a large body.

REQUEST TO OBSERVERS

The new positions of asteroid 5025 P-L are urgently needed. In a search for eventual trails of this object on plates exposed in 1960-1961, which can be found in archives, you can make use of the ephemeris given in Table 1 (α, δ – right ascension and declination of the object; D, R – distances from the Earth and Sun; mag. $= 16.9 + 5\log D + 5\log R$; $\Delta\alpha, \Delta\delta$ – changes in α and δ when the perihelion time is changed by 1 day: T+1, and the semimajor axis is changed by 0.01 AU: a + 0.01).

The ephemeris was computed on the basis of the following values of orbital elements of asteroid 5025 P-L (Van Houten et al. 1984):

T = 1961 Jan. 18.6604 ET EPOCH = 1960 Sep. 23.0 ET

ω = 149.°9300	1950.0	e = 0.895400
Ω = 355.°9100		a = 4.200600 AU
i = 6.°2000		n = 0.°1144820
q = 0.439383 AU		P = 8.609 years

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Table 1

Ephemeris for asteroid 5025 P-L

DATE (E.T.)	$\alpha_{1950.0}$	$\delta_{1950.0}$	D	R	mag.	T+1		a + 0.01	
						$\Delta\alpha$	$\Delta\delta$	$\Delta\alpha$	$\Delta\delta$
	h m	o /				m	′	m	′
1960 Sep. 23	1 28.62	+12 58.1	1.148	2.098	18.8	-1.78	-13.6	+0.57	+4.3
28	1 21.87	+12 42.8	1.062	2.035					
Oct. 3	1 13.59	+12 20.0	0.983	1.971	18.3	-1.91	-16.0	+0.65	+5.0
8	1 03.69	+11 48.7	0.910	1.906					
13	0 52.13	+11 08.0	0.844	1.839	17.9	-1.89	-18.2	+0.72	+5.8
18	0 38.98	+10 17.1	0.787	1.772					
23	0 24.42	+ 9 16.1	0.737	1.703	17.4	-1.52	-19.2	+0.76	+6.7
28	0 08.77	+ 8 06.0	0.695	1.633					
Nov. 2	23 52.41	+ 6 48.5	0.661	1.562	17.0	-0.78	-17.8	+0.73	+7.1
7	23 35.79	+ 5 26.2	0.633	1.489					
12	23 19.31	+ 4 01.8	0.612	1.415	16.6	+0.34	-13.5	+0.62	+6.9
13	23 16.07	+ 3 44.9	0.608	1.400					
14	23 12.85	+ 3 28.1	0.604	1.385	16.5	+0.60	-12.3	+0.59	+6.8
15	23 09.65	+ 3 11.4	0.601	1.370					
16	23 06.48	+ 2 54.7	0.597	1.355	16.4	+0.88	-11.0	+0.57	+6.7
17	23 03.34	+ 2 38.2	0.594	1.339					
18	23 00.23	+ 2 21.8	0.591	1.324	16.4	+1.16	-9.8	+0.54	+6.4
19	22 57.16	+ 2 05.5	0.588	1.309					
20	22 54.11	+ 1 49.3	0.585	1.293	16.3	+1.44	-8.3	+0.50	+6.4
21	22 51.09	+ 1 33.4	0.583	1.278					
22	22 48.11	+ 1 17.5	0.580	1.262	16.2	+1.74	-6.8	+0.47	+6.2
23	22 45.15	+ 1 01.8	0.577	1.247					
24	22 42.23	+ 0 46.3	0.575	1.231	16.1	+2.05	-5.2	+0.43	+6.0
25	22 39.34	+ 0 31.0	0.572	1.215					
26	22 36.47	+ 0 15.8	0.570	1.199	16.1	+2.37	-3.6	+0.40	+5.8
27	22 33.63	+ 0 00.8	0.567	1.183					
28	22 30.81	- 0 14.1	0.565	1.167	16.0	+2.71	-1.9	+0.36	+5.6
29	22 28.01	- 0 28.8	0.562	1.151					
30	22 25.23	- 0 43.4	0.560	1.135	15.9	+3.06	-0.2	+0.32	+5.3
Dec. 1	22 22.46	- 0 57.9	0.558	1.119					
2	22 19.71	- 1 12.3	0.555	1.103	15.8	+3.43	+1.7	+0.28	+5.1
3	22 16.96	- 1 26.6	0.552	1.087					
4	22 14.21	- 1 40.9	0.550	1.070	15.7	+3.82	+3.7	+0.25	+4.8
5	22 11.47	- 1 55.1	0.547	1.054					
6	22 08.71	- 2 09.4	0.544	1.038	15.7	+4.23	+5.8	+0.21	+4.6
7	22 05.95	- 2 23.6	0.542	1.021					
8	22 03.16	- 2 37.9	0.539	1.004	15.6	+4.67	+8.0	+0.17	+4.3
9	22 00.35	- 2 52.3	0.536	0.988					
10	21 57.51	- 3 06.9	0.533	0.971	15.5	+5.14	+10.5	+0.12	+4.1
11	21 54.63	- 3 21.6	0.530	0.955					
12	21 51.70	- 3 36.5	0.527	0.938	15.4	+5.65	+13.1	+0.08	+3.9
13	21 48.72	- 3 51.6	0.523	0.921					
14	21 45.67	- 4 07.1	0.520	0.904	15.3	+6.21	+15.8	+0.04	+3.5
15	21 42.56	- 4 23.0	0.517	0.887					
16	21 39.35	- 4 39.3	0.513	0.871	15.2	+6.81	+19.0	-0.01	+3.2
17	21 36.06	- 4 56.1	0.510	0.854					
18	21 32.65	- 5 13.4	0.506	0.837	15.0	+7.47	+22.3	-0.06	+2.9
19	21 29.13	- 5 31.3	0.503	0.820					
20	21 25.48	- 5 50.0	0.499	0.803	14.9	+8.19	+26.0	-0.11	+2.6
21	21 21.68	- 6 09.4	0.496	0.786					
22	21 17.73	- 6 29.7	0.492	0.769	14.8	+8.97	+29.9	-0.16	+2.3
23	21 13.61	- 6 50.9	0.489	0.753					
24	21 09.30	- 7 13.2	0.485	0.736	14.7	+9.81	+34.2	-0.22	+2.0
25	21 04.79	- 7 36.5	0.482	0.719					
26	21 00.06	- 8 01.0	0.479	0.703	14.5	+10.73	+38.7	-0.27	+1.6
27	20 55.12	- 8 26.7	0.476	0.686					
28	20 49.94	- 8 53.7	0.474	0.670	14.4	+11.68	+43.3	-0.32	+1.2
29	20 44.52	- 9 22.0	0.472	0.654					
1961 Feb. 10	18 59.44	-25 29.1	1.101	0.681	16.3	+0.86	+6.7	-0.26	-0.2
15	19 11.62	-25 41.2	1.184	0.764					
20	19 23.47	-25 45.5	1.256	0.848	17.0	+0.36	+3.5	-0.28	-0.5
25	19 34.68	-25 44.4	1.319	0.932					
Mar. 2	19 45.12	-25 39.8	1.373	1.016	17.6	+0.22	+1.9	-0.28	-0.8
7	19 54.75	-25 33.4	1.419	1.098					
12	20 03.56	-25 26.1	1.458	1.178	18.1	+0.18	+1.0	-0.29	-1.0
17	20 11.53	-25 18.8	1.490	1.257