

NON-PRINCIPAL AXIS ROTATION (TUMBLING) ASTEROIDS

Asteroid	PAR	Per ₁	Amp ₁	Per ₂	Amp ₂	Reference
244 Sita	T0 0	129.51 129.51	0.82 0.82			Brinsfield, 09
253 Mathilde	T -3 -3	417.7 417.7 418.	0.50 0.45 0.5	250. 250.		Mottola, 95 Pravec, 05
288 Glauke	T -1 0 -2	1170. 1200. 1170.	0.9 0.9 0.37	740.		Harris, 99 Pravec, 14 Pilcher, 15
299 Thora	T0 0	274. 274.	0.39 0.39			Pilcher, 14
408 Fama	T0 0	202.1 202.1	0.58 0.58			Stephens, 08
470 Kilia	T0 0 0	290. 290.	0.26 0.26			Stephens, 09 Stephens, 09
571 Dulcinea	T -2	126.3 126.3	0.50 0.50			Stephens, 11
630 Euphemia	T0 0	350. 350.	0.45 0.45			Warner, 11
707 Steina	T0 0	414.	1.00			Pravec, 14
823 Sisigambis	T0 0	146.	0.7			Pravec, 14
824 Anastasia	T- +2 +2	250. 250.	1.20 1.20			Stephens, 10 Pravec, 14
846 Lipperta	T0 0	1641. 1641.	0.30 0.30			Buchheim, 11
887 Alinda	T0 0	73.97	0.35			Pravec, 14
912 Maritima	T0 0	1332.	0.18			Pravec, 14
950 Ahrensa	T0 0	202.	0.40			Pravec, 14
989 Schwassmannia	T0 0 0	107.85 107.85 120.3	0.39 0.35 0.39			Benishek, 14 Stephens, 14
1042 Amazone	T0 0	540.	0.25			Pravec, 14
1183 Jutta	T0 0	212.5 212.5	0.10 0.10			Stephens, 11
1235 Schorria	T0 -1 0	1265. 1265.	1.40 1.40			Warner, 09 Pravec, 14
1244 Deira	T0 0	210.6	0.50			Pravec, 14
1278 Kenya	T -2	188. 188.	0.75 0.75	127.		Oey, 12
1447 Utra	T0 0	257. 257.	0.63 0.63			Martinez, 11w
1451 Granö	T -2	138.00 138.	0.65 0.65			Stephens, 10
1473 Ounas	T+ -1 -2 -2	139.1 139.1 139.1	0.6 0.57 0.6			Behrend, 13w Pilcher, 13 Pravec, 14
1479 Inkeri	T -2	660. 660.	1.30 1.3			Ferrero, 12
1506 Xosa	T0 0	292. 292.	0.70 0.70			Warner, 11
1512 Oulu	T? -1 -1	132.3 132.3	0.33 0.33			Galad, 10 Pravec, 14
1536 Pielinen	T+ -2 -2	66.22 66.22	0.85 0.85	52.05		Pravec, 11w Pravec, 14

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Asteroid	PAR	Per ₁	Amp ₁	Per ₂	Amp ₂	Reference
1573 Väisälä	T? -1	252. 252.	0.76 0.76			Pravec, 12w
1575 Winifred	T0 0	125.	1.20			Pravec, 14
1621 Druzhba	T- +2	99.20	0.75			Pravec, 14
1663 van den Bos	T0 0	740.	0.80			Pravec, 14
1689 Floris-Jan	T? -1	145. 144.85	0.4 0.4			Harris, 89
1703 Barry	T? 0	107.1 107.1	0.50 0.5			Galad, 07
1750 Eckert	T- -2	375. 375.	0.87 0.87			Warner, 10
1775 Zimmerwald	T- -1	122. 122.	0.6 0.60			Stephens, 11
1807 Slovakia	T0 0	308.6	1.10			Pravec, 14
1909 Alekhin	T0 0 0	148.6 148.6	0.45 0.45			Dymock, 09 Pravec, 14
1919* Clemence	T0 0	67.4	0.60			Pravec, 14
1954 Kukarkin	T0 +1	136.40 136.40	0.80 0.80			Alvarez, 13
1989 Tatry	T? 0 -1	131.3 131.3	0.50 0.5			Galad, 09 Pravec, 14
2000 Herschel	T+ -2 -2	130. 130.	1.16 1.16			Warner, 11 Pravec, 14
2035 Stearns	T- -2	93. 93.	0.7 0.63			Stephens, 14
2062 Aten	T0 0	40.77	0.26			Pravec, 14
2423 Ibarruri	T- +1 +1	139.79 139.79	0.74 0.74			Pravec, 11w Pravec, 14
2430 Bruce Helin	T0 0	128.	0.61			Pravec, 14
2437 Amnestia	T0 0	85.	0.45			Pravec, 14
2639 Planman	T0 0	89.5	0.40			Pravec, 14
2675 Tolkien	T? 0 -1	1060. 1060.	0.75 0.75			Durkee, 11 Pravec, 14
2696 Magion	AT0 0 0	480. 480.	0.31 0.31			Galad, 09 Pravec, 14
2705 Wu	T- -2	150.5 150.5	1.2 1.2			Oey, 10
2731* Cucula	T? -1	61.55 61.69	0.40 0.3			Brinsfield, 12
2735 Ellen	T0 0	159.	1.50			Pravec, 14
2772* Dugan	T0 0	235. 235.	1.14 1.14			Pravec, 12w
2862 Vavilov	T0 0	800.	0.4			Pravec, 14
2870 Haupt	T0 0	274. 274.	0.60 0.54			Pravec, 11w
2874 Jim Young	T0 0	131.3	0.75			Pravec, 14
2942 Cordie	T- -2	80.0 80.0	1.1 1.1			Pravec, 06w

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Asteroid	PAR	Per ₁	Amp ₁	Per ₂	Amp ₂	Reference
2974 Holden	T0 0	856. 856.	0.70 0.70			Stephens, 16
3033 Holbaek	T- 2 +2	233.3 233.3	1.20 1.20			Brinsfield, 12 Pravec, 14
3043 San Diego	T0 0	105.7 105.7	0.60 0.60			Warner, 09
3102* Krok	T- +2	149.4 151.8	1.6 1.3			Pravec, 05
3138 Ciney	DT0 0	113.	0.56			Pravec, 14
3288 Seleucus	T -2 -1	75. 75. 75.	1.0 1.0 1.0			Pravec, 05 Harris, 99
3353 Jarvis	T0 0	202.0 202.0	0.50 0.50			Warner, 09
3447 Burckhalter	T+ -2 -2	59.8 59.8	0.39 0.39	67.5	0.39	Warner, 11 Pravec, 14
3527 McCord	T0 0	321. 321.	0.44 0.44			Pravec, 09w
3571* Milanštefánik	T0 0	421.1 421.1	0.65 0.65			Warner, 17
3635 Kreutz	T0 0	280. 280.	0.25 0.25			Warner, 13
3691 Bede	T -2 -2	226.8 227. 226.8	0.5 0.5 0.5			Pravec, 05 Pravec, 98
3752 Camillo	T- +2	37.846	1.1			Pravec, 05
3833 Calingasta	T -2 0	199. 199. 195.	1.20 0.7 0.80			Pravec, 10w Owings, 13
3888 Hoyt	T0 0	84.2	0.70			Pravec, 14
3940 Larion	T0 0	84.	0.31			Pravec, 14
4002 Shinagawa	T0 0	175.0 175.0	0.95 0.95			Stephens, 15
4024 Ronan	T- 2	356. 356.	1.10 1.10			Stephens, 10
4142 Dersu-Uzala	T? -1	140. 140.	0.60 0.60			Warner, 09
4179 Toutatis	T -4 -2 -2	176. 176. 180. 130.	1.46 1.2 1.0 0.5	130.		Pravec, 05 Nakamura, 98 Hudson, 95
4232 Aparicio	T0 0	54.4	0.83			Pravec, 14
4283 Stöffler	T0 0	136.	0.65			Pravec, 14
4450 Pan	T -1 0	56.48 60. 56.48	0.64 0.6 0.64			Pravec, 08w Warner, 14
4486* Mithra	RT0 0	67.5 67.5	1.			Brozovic, 10
4524 Barklajdetolli	T0 0	1069. 1069.	1.26 1.26			Pray, 10
4544 Xanthus	T0 0	37.65	0.27			Pravec, 14
4660 Nereus	T0 0	15.1	0.8			Pravec, 14
4678 Ninian	T? -1	56.72 56.7	1.04 0.93			Pravec, 14w
4689* Donn	T0 0	122.5 122.5	0.64 0.64			Pravec, 16w

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4690* Strasbourg	T -2	69.2 69.2	0.80 0.75	52.05		Warner, 11
4902 Thessandrus	T -2	738. 738.	0.60 0.60			French, 13
5171 Augustesen	T? -1	480. 480.	0.8 0.8			Galad, 07
5202 Charleseliot	T? -1	183. 183.	0.58 0.58			Pravec, 12w
5230 Asahina	T- 0 +2	89.3 89.3	0.67 0.67			Warner, 10 Pravec, 14
5247 Krylov	T+ -3 -2 -2	81.5 81.5	1.5 1.5	62.85		Pravec, 06w Pravec, 14 Pravec, 14
5390 Huichiming	T0 0	111.	0.75			Pravec, 14
5511 Cloanthus	T0 0	336.	0.49			Pravec, 14
5561 Iguchi	T0 0	112.4	0.43			Pravec, 14
5577 Priestley	T -2	160. 160.	0.85 0.85	30.7		Stephens, 14
5630 Billschaefer	T0 0	69.	0.9			Pravec, 14
5641 McCleese	T0 0	418.	1.3			Pravec, 14
5645 1990 SP	T -2	30.39 30.39	0.7 0.7			Pravec, 05
5691 Fredwatson	T0 0	106.0	1.2			Pravec, 14
5751 Zao	T0 0	76.	0.2			Pravec, 14
5752 1992 CJ	T0 0	86.	0.80			Pravec, 14
5774 Ratliff	T0 0	61.	0.6			Pravec, 14
5786 Talos	NT0 0	38.52	0.23			Pravec, 14
5851 Inagawa	T? -1	367.5	0.90			Pravec, 14
5967 Edithlevy	T -2	66. 66.	0.7 0.7			Warner, 10
6063 Jason	T -2	51.7 51.7	0.11 0.11	238.	0.12	Warner, 14
6141 Durda	T0 0	460. 460.	0.50 0.50			Warner, 10
6183 Viscome	T? -1 -1	453. 437. 453.	0.90 0.68 0.9			Pravec, 15w Stephens, 16
6192 Javiergorosabel	T+ -2 -2	78.85 78.74	0.95 0.95			Brinsfield, 12 Pravec, 14
6250 Saekohayashi	T0 0	82.6	0.78			Pravec, 14
6271 Farmer	T? -1 -1 -1	250. 250. 250.	0.22 0.13 0.22			Warner, 11w Warner, 11w Pravec, 14
6425 1994 WZ ₃	T0 0	103.9 103.9	0.92 0.92			Durkee, 11
6435 Daveross	T- +2 +2	51.25 51.25	0.67 0.67			Warner, 11 Pravec, 14
6461 Adam	T	74.	0.76			

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Asteroid	PAR	Per ₁	Amp ₁	Per ₂	Amp ₂	Reference
	-2	74.	0.76	74.	47.	Warner, 12
6485 Wendeesther	T0 0	74.82	1.00			Pravec, 14
6487 Tonyspear	T- +2	74.91	1.24			Pravec, 14
6498 Ko	T0 0	500.	0.6			Pravec, 14
6911* Nancygreen	T0 0	54.7	0.75			Pravec, 14
7352 1994 CO	T -2	648. 648.	0.30 0.30			Stephens, 14
7421 Kusaka	T -2	96.5 96.5	0.70 0.7			Galad, 10
7480 Norwan	T0 0	35.90	0.5			Pravec, 14
7743 1986 JA	T? -1	146.8 146.8	0.93 0.93			Pravec, 08w
7781 Townsend	T- +2 +2	81.1 81.1	0.58 0.58			Warner, 11 Pravec, 14
7824 Lynch	T0 0 +1	75.30	0.37			Pravec, 14 Pravec, 14
8736 Shigehisa	T0 0	80.5	1.2			Pravec, 14
8885 Sette	T0 0	212.	0.5			Pravec, 14
9000 Hal	T0 0	908.	0.9			Pravec, 14
9165 Raup	T0 -1 0	1320. 560. 1320.	1.34 1.05 1.34			Warner, 14 Warner, 16
9233 Itagijun	T0 0	110.95	0.6			Pravec, 14
9400* 1994 TW ₁	T? -1 0	97.1 82.8 97.1	1.04 0.80 1.04			Warner, 16 Warner, 16
9556 Gaywray	T0 0	920.	0.5			Pravec, 14
9584 Louchheim	T0 0	410. 410.	0.3 0.3			Pravec, 09w
9739 Powell	T? -1	109. 109.	0.40 0.40			Stephens, 15
9969 Braille	T0 0	226.4	0.9			Pravec, 14
10302 1989 ML	T0 0	19.	1.00			Pravec, 14
10531 1991 GB ₁	T0 0	55.1	0.21			Pravec, 14
10772 1990 YM	NT? -1 -1	68.7 68.7	1.3 1.3		1.3	Pravec, 06w Pravec, 14
11304 Cowra	T0 0 0	95.7 95.7 94.5	1.0 0.40 1.0			Warner, 09 Warner, 12
11351 Leucus	T0 0	515. 515.	0.53 0.53			French, 13
11398 1998 YP ₁₁	T- +2	38.60 38.60	0.34 0.25			Pravec, 05
11500 Tomaiyowit	NT0 0	73.0	0.5			Pravec, 14
11579 Tsujitsuka	T? -1	56.6 56.6	0.8 0.8	24.		Pravec, 15w
11780 Thunder Bay	T0 0	295.	0.70			Pravec, 14

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11789 Kempowski	AT0 0	48.6	0.45			Pravec, 14
12265 1990 FG	T- +2 +2	56.6 56.6	0.65 0.65			Warner, 11 Pravec, 14
13331 1998 SU ₅₂	T? -1	375.	0.80			Pravec, 14
13553 Masaakikoyama	NT -2	38. 38.	1.1 1.1			Pravec, 05w
13643 Takushi	T0 0	83.838 83.838	1.00 1.00			Clark, 13
13651 1997 BR	T -1 -2	33.644 33.644 33.64	1.2 1.2 1.2			Pravec, 98 Pravec, 05
14040 Andrejka	T0 0	310.	0.95			Pravec, 14
14395 Tommorgan	T -2	35.5 35.5	0.61 0.61	40.4		Warner, 13
14764 Kilauea	T+ -2 -2 0	19.84 19.84 19.59	1.2 0.81 0.50	22.86		Warner, 12 Pravec, 14 Stephens, 15
14815 Rutberg	T0 0	150.	1.0			Pravec, 14
15533 2000 AP ₁₃₈	T0 0	114.	0.38			Pravec, 14
15977* 1998 MA ₁₁	T? -1	250. 250.	0.30 0.30			Stephens, 16
16064 Davidharvey	T -2	178.5 178.5	0.7 0.7			Pravec, 05
16256 2000 JM ₂	T0 0	63.5 63.5	0.98 0.98			Warner, 12
16421 Roadrunner	T0 0 0	174. 173. 174.	1.25 1.25 1.00			Warner, 12 Warner, 14
16558 1991 VQ ₂	T0 0	170.	1.0			Pravec, 14
16589 Hastrup	T -2	128. 128.	0.62 0.62			Warner, 12
16641 Esteban	0	79.62 79.51	1.42 1.42			Pravec, 14w
16843* 1997 XX ₃	T? -1	275. 275.	0.41 0.41			Warner, 16w
16896 1998 DS ₉	T? -1	708. 708.	0.43 0.43			Stephens, 14
17584 1994 XF ₁	T -2	4.6398 4.6398	0.56 0.56	5.7306		Pravec, 15w
17681 Tweedledum	T0 0	75.2	0.90			Pravec, 14
18096 2000 LM ₁₆	T0 0	86.	0.18			Pravec, 14
18582 1997 XK ₉	T0 0	114.	0.94			Pravec, 14
18906 2000 OJ ₁₉	T0 0	77.90	0.80			Pravec, 14
19034* Santorini	T0 0	247. 247.	0.43 0.43			Warner, 17
19537 1999 JL ₈	AT0 0	50.1	0.10			Pravec, 14
19711* Johnligawesa	T0 0	54.3 54.3	0.25 0.25			Pravec, 16w
19763 Klimesh	T? -1	101. 101.	0.67 0.67			Pravec, 11w
19764 2000 NF ₅	NT0 0	59.3	0.80			Pravec, 14

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20231 1997 YK	T? 0	178. 178.	0.70 0.70			Warner, 14
20562 1999 RV ₁₂₀	T0 0	135.4 135.4	0.43 0.43			Pravec, 14w
20571 Tiamorrison	T0W 0	450.	0.60			Pravec, 14
20996 1986 PB	T0 0	43.6	0.4			Pravec, 14
21609 Williamcaleb	T0 0	112.	0.5			Pravec, 14
22166 2000 WX ₁₅₄	T0 0	800. 800.	0.46 0.46			Pravec, 11w
22357 1992 YJ	T0 0	103. 103.	0.54 0.54			Warner, 11
24077 1999 TD ₂₃₃	T -2	30.86 30.86	1.61 1.61	33.13		Warner, 14
24242 1999 XY ₁₀₀	T+ -2 -2	49.94 49.94	0.6 0.6			Pravec, 08w Pravec, 14
24702 1991 OR	T0 0	59.5	0.19			Pravec, 14
25076 1998 QM ₉₈	T -2	58.3 58.3	0.35 0.35			Warner, 15
25143 Itokawa	T- +4	12.132	1.05			Pravec, 05
27810 Daveturner	T0 0	546. 546.	0.43 0.43			Warner, 11
28017 1997 YV ₁₃	T? -1 -1	47. 47.	0.15 0.15		0.15	Pravec, 05w Pravec, 14
29147 1988 GG	T -2	99. 99.	0.80 0.80			Warner, 10
29292 Conniewalker	T+ -2 -2 -2	30.6 30.5 30.6	0.63 0.63 0.62	22.55		Pravec, 11w Brinsfield, 12 Pravec, 14
29780 1999 CJ ₅₀	T0 0	63.50	0.58			Pravec, 14
31013* 1996 DR	T0 0	280. 280.	0.5 0.5			Pravec, 16w
31076 1996 XH ₁	AT0 0	350.	0.17			Pravec, 14
31173 1997 XF ₁	T0 0	122.8 122.8	0.67 0.67			Warner, 14
31182* 1997 YZ ₃	T0 0	380.	0.90			Pravec, 14
31832 2000 AP ₅₉	T -2	64. 64.	0.8 0.8			Stephens, 15
32928 Xiejialin	T0 0	38.9	0.56			Pravec, 14
33319 Kunqu	T? -1	105. 105.	0.9 0.9			Warner, 16
33341 1998 WA ₅	T- +1	204. 204.	0.57 0.57			Warner, 10
33356 1999 AM ₃	T- +2	37.59 37.59	0.92 0.92			Warner, 12
33736 1999 NY ₃₆	T? -1	211. 211.	0.4 0.4			Stephens, 12
33816 2000 AL ₄₂	AT0 0	193.	0.12			Pravec, 14
35259* 1996 HN ₂₄	T0 0	230. 230.	0.45 0.45			Pravec, 16w
36298 2000 JF ₁₀	T? -1	82. 82.	0.75 0.75			Warner, 10

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36316 2000 <i>LC</i> ₁₂	T -2	56.5 56.5	1.22 1.22	46.4		Warner, 12
37586* 1991 <i>BP</i> ₂	T0 0	900. 900.	0.96 0.96			Pravec, 16w
37634 1993 <i>UZ</i>	T0 0	82.0 82.0	0.70 0.70			Warner, 10
37635 1993 <i>UJ</i> ₁	T0 0	600.	0.8			Pravec, 14
38063 1999 <i>FH</i>	T? -1	990. 990.	0.55 0.55			Stephens, 15
38071 1999 <i>GU</i> ₃	T? -1 -1	216. 216. 215.	1.50 1.4 1.5			Pravec, 00 Pravec, 02w
39240 2000 <i>YZ</i> ₆₉	T0W 0	105.	1.6			Pravec, 14
39420 Elizabethgaskell	T0W 0	105.	1.6			Pravec, 14
39618 1994 <i>LT</i>	T -2	140. 140.	0.85 0.85			Warner, 12
39796 1997 <i>TD</i>	T? -1	223.5 223.5	0.92 0.92			Warner, 15
41424 2000 <i>CK</i> ₄₀	T0 0	48.0	0.35			Pravec, 14
41503 2000 <i>QG</i> ₁₄₈	T0 0	42.81 42.81	1.00 1.00			Warner, 14
41660 2000 <i>SV</i> ₃₆₂	T0 0	77.2 77.2	0.65 0.65			Stephens, 14
42286* 2001 <i>TN</i> ₄₁	T- 0	77.9 77.9	0.44 0.44			Warner, 17
43606 2001 <i>XQ</i> ₂	T? -1	87. 87.	1.3 1.3			Warner, 10
44534 1998 <i>YZ</i> ₉	ADT0W T0	45.0	0.75			Pravec, 14
48707 1996 <i>KR</i> ₁	T0 0	230.	0.75			Pravec, 14
51371 2000 <i>XF</i> ₁₅	AT0 0	54.	0.09			Pravec, 14
51386 2001 <i>CN</i> ₃₅	T0 0	48.0	0.36			Pravec, 14
52387 1993 <i>OM</i> ₇	T0 0	26.	0.4			Pravec, 14
53008 1998 <i>VY</i> ₅	0	47. 47.	0.30 0.3			Pravec, 13w
53319 1999 <i>JM</i> ₈	T -2	136. 136.	0.7 0.7			Pravec, 05
53789 2000 <i>ED</i> ₁₀₄	NT0 0	43.	1.1			Pravec, 14
54071 2000 <i>GQ</i> ₁₄₆	NT0 0	51.	0.2			Pravec, 14
54789 2001 <i>MZ</i> ₇	T+ -3 -3	37.57 37.57	1.4 1.4	52.79		Pravec, 05 Pravec, 14
55532* 2001 <i>WG</i> ₂	T -2	46.08 46.08	0.55 0.55	32.4		Stephens, 14
56367 2000 <i>EF</i>	AT0 0	98.	0.8			Pravec, 14
57868 Pupin	T0 0	108.10 108.10	0.93 0.93			Benishek, 16
58155* 1988 <i>VD</i>	T? -1	7.093 7.093	0.36 0.36	8.02	0.14	Warner, 16
59493 1999 <i>JG</i> ₅	T0 0	57.4	0.90			Pravec, 14
64107 2001 <i>TK</i> ₈	T? -1	68.5 68.5	1.31 1.31			Warner, 15

NON-PRINCIPAL AXIS ROTATION (TUMBLING) ASTEROIDS

Asteroid	PAR	Per ₁	Amp ₁	Per ₂	Amp ₂	Reference
65407 2002 <i>RP</i> ₁₂₀	T0 0	200.	0.6			Pravec, 14
65637 Tsniimash	T -1	220. 220.	0.90 0.90			Stephens, 14
65717 1993 <i>BX</i> ₃	T0 0	20.463	0.91			Pravec, 14
66092 1998 <i>SD</i>	T0 0	448. 448.	0.42 0.42			Warner, 13
66419 1999 <i>NR</i> ₁₃	+2	56.71 56.71	0.80 0.80			Alvarez, 13
68547 2001 <i>XW</i> ₂₉	T+ -2 -2	36.7 36.7	0.60 0.60			Warner, 10 Pravec, 14
69350 1993 <i>YP</i>	AT? -1 -1	31.79 32.34	0.95 0.95			Warner, 12 Pravec, 14
74081 1998 <i>OU</i> ₁	T0 0	46.1	0.23			Pravec, 14
76800 2000 <i>OQ</i> ₃₅	T0 0	392.	1.4			Pravec, 14
79316 Huangshan	T? -1	493. 493.	0.62 0.62			Stephens, 15
85953* 1999 <i>FK</i> ₂₁	T? 0	17.62 28.1	0.60 0.60			Skiff, 11w
86039 1999 <i>NC</i> ₄₃	AT? -1	34.49 34.29	1.10 1.00			Warner, 14
86666 2000 <i>FL</i> ₁₀	T? -1	206. 206.	0.85 0.85			Warner, 16
89136 2001 <i>US</i> ₁₆	T -3	14.39 14.39	0.90 0.90	37.4		Pravec, 04w
89355 2001 <i>VS</i> ₇₈	T- +2	40.553 40.553	0.52 0.52			Pravec, 05
95711 2003 <i>AK</i>	NT0 0	100.	0.7			Pravec, 14
96590 1998 <i>XB</i>	NT0 0	520.	1.0			Pravec, 14
99475 2002 <i>CR</i> ₁₁₈	T0 0	81.	0.74			Pravec, 14
99812 2002 <i>LW</i> ₃₁	T0 0	150.	0.8			Pravec, 14
99942 Apophis	T -3	30.56 30.56	1.14 1.14	27.38		Pravec, 14
101430 1998 <i>VE</i> ₃₂	T0 0	40.66	0.22			Pravec, 14
101549* 1998 <i>YY</i> ₂₉	T0 0	56.7 56.7	0.70 0.51			Warner, 09
105844 2000 <i>SH</i> ₁₆₀	T0 0	38.26	1.45			Pravec, 14
106620 2000 <i>WL</i> ₁₂₄	T- +2 +2	104.5 104.5	0.58 0.58			Warner, 12 Pravec, 14
120578 1995 <i>QV</i> ₁₂	T? 0	72.4 72.4	0.51 0.51			Warner, 14
122463* 2000 <i>QP</i> ₁₄₈	T0 0	426. 426.	1.13 1.13			Pravec, 16w
123937 2001 <i>EX</i> ₁₆	T0 0	39.82	0.07			Pravec, 14
125742* 2001 <i>XT</i> ₁₁₇	T? -1	60.8 60.8	1.40 1.15			Warner, 13
134422 1998 <i>QM</i> ₃	T -1	25.4 25.4	0.65 0.65	34.2	0.60	Warner, 15
134549 1999 <i>RN</i> ₁₅₄	T? -1	124. 124.	0.55 0.55			Warner, 14
135486 2001 <i>XP</i> ₂	T0 0	69.	1.2			Pravec, 14

NON-PRINCIPAL AXIS ROTATION (TUMBLING) ASTEROIDS

Asteroid	PAR	Per ₁	Amp ₁	Per ₂	Amp ₂	Reference
141018 2001 WC ₄₇	T0 0	16.51 16.51	0.18 0.18			Warner, 12
143651 2003 QO ₁₀₄	T? -1 -1	114.4 114.4 114.	1.60 1.60 1.25			Warner, 09 Koehn, 14
143678 2003 SA ₂₂₄	NAT0 0	35.	0.24			Pravec, 14
144411 2004 EW ₉	T- +2	49.94 49.94	1.9 0.9			Pravec, 04w
152664 1998 FW ₄	T0 0	17.38 17.38	0.34 0.34			Warner, 14
152679 1998 KU ₂	T -2	125. 125.	1.35 1.35			Warner, 16
154807 2004 PP ₉₇	T? -1	161. 161.	0.96 0.96			Warner, 16
162004 1991 VE	T+ -2	13.4802 13.4802	1.11 1.08	17.316		Pravec, 12w
162058 1997 AE ₁₂	NT0 0	1880.	0.6			Pravec, 14
162416 2000 EH ₂₆	RT0 0	24.				Pravec, 14
162900 2001 HG ₃₁	T -1 -3	60.61 59.58 60.61	0.56 0.56 0.50	39.0		Warner, 09 Pravec, 08w
162998 2001 SK ₁₆₂	NT0 0	68.	0.40			Pravec, 14
163081 2002 AG ₂₉	T0 0	19.70	0.25			Pravec, 14
163696 2003 EB ₅₀	T0 -1 0	62.4 27.2 62.4	0.83 0.73 0.83	31.4		Warner, 14 Warner, 16
163732 2003 KP ₂	NT? -1	151.1 151.1	1.7 1.7			Pravec, 03w
163899 2003 SD ₂₂₀	T? -1	285. 285.	2.2 2.2			Warner, 16
164400 2005 GN ₅₉	T- 0 +1	38.69 38.69	1.30 1.30			Skiff, 12 Pravec, 14
168381 1997 LY ₄	T -2	46.07 46.07	1.0 1.0			Pravec, 00
179806 2002 TD ₆₆	T0 0	9.455	1.16			Pravec, 14
181882 1999 RF ₁₄	T? 0	2.5 2.5	0.20 0.20			Skiff, 11w
183581 2003 SY ₈₄	T? -1	260. 260.	0.87 0.87			Warner, 15
188077 2001 XW ₄₇	T0 0	525.	0.3			Pravec, 14
206378 2003 RB	T? 0 0	37.5 37.5	0.43 0.43			Pravec, 14 Warner, 16
217807 2000 XK ₄₄	T -1 -3	51.9 66.75 51.9	1.2 0.5 1.2	25.7 66.8		Hicks, 10 Warner, 10
218144 2002 RL ₆₆	T0B? 0 0	587. 590. 587.	0.32 0.32 0.25			Warner, 10 Warner, 10
234145 2000 EW ₇₀	RT0 0	33.				Pravec, 14
242191 2003 NZ ₆	T0 0	13.531	1.5			Pravec, 14
253106 2002 UR ₃	T? -1	180. 180.	0.36 0.36			Warner, 16
267337 2001 VK ₅	T? -1	39.05 39.05	0.92 0.92			Warner, 14

NON-PRINCIPAL AXIS ROTATION (TUMBLING) ASTEROIDS

Asteroid	PAR	Per ₁	Amp ₁	Per ₂	Amp ₂	Reference
267729 2003 <i>FC</i> ₅	NT0 0	129.5	0.5			Pravec, 14
275974* 2001 <i>XD</i>	T0 0	26.1 26.1	0.50 0.50			Warner, 16
302831 2003 <i>FH</i>	T0 0	13.94	0.99			Pravec, 14
306790 2001 <i>KB</i> ₁	T? -1	71. 71.	0.85 0.85			Warner, 15
308635 2005 <i>YU</i> ₅₅	AT0 -1 0	19.31	0.30			Muller, 13 Pravec, 14
329770 2004 <i>JA</i>	NT0 0	52.1	0.4			Pravec, 14
331471* 1984 <i>QY</i> ₁	T -2	45.5 45.5	0.65 0.65	36.6		Warner, 16
345853 2007 <i>PU</i> ₁₁	T0 0	56.8	0.98			Pravec, 14
363084 2000 <i>RD</i> ₅₃	NT0 0	14.96	0.09			Pravec, 14
368664 2005 <i>JA</i> ₂₂	T? -1	31.7 31.7	0.92 0.92			Warner, 14
369984 1998 <i>QR</i> ₅₂	NT- +1	234.	0.88			Pravec, 14
374158 2004 <i>UL</i>	T -2	38. 38.	1.2 1.2			Warner, 15
374851 2006 <i>VV</i> ₂	B -1	2.425 1.704	0.57 0.2	94.	0.3	Vereshchagina, 09
380929 2006 <i>HU</i> ₃₀	T? -1	49.0 49.0	0.17 0.17	450.		Warner, 14
388945* 2008 <i>TZ</i> ₃	T? -1	44.2 44.2	0.56 0.56	52.4	0.49	Warner, 16
398188 Agni	T -2	21.99 21.99	1.12 1.12			Warner, 15
411201 2010 <i>LJ</i> ₁₄	T0 0	113. 113.	0.85 0.85			Warner, 14
413260 2003 <i>TL</i> ₄	NT0 0	27.2	1.0			Pravec, 14
415949 2001 <i>XY</i> ₁₀	T0 0	43.5 43.5	0.35 0.35			Warner, 15
416186 2002 <i>TD</i> ₆₀	T+ -3 -3 -3 -4 -3	2.8513 2.8513 2.8516 2.8512 2.8504	2.0 1.4 1.5 2.0 1.15	6.781 6.784 6.784 6.783		Pravec, 05 Pravec, 05 Pravec, 05 Pravec, 14 Warner, 15
422638 1994 <i>CB</i>	T- +1	8.676	0.90			Pravec, 14
429584 2011 <i>EU</i> ₂₉	T0 0	43.5 43.5	0.65 0.65			Warner, 15
443103 2013 <i>WT</i> ₆₇	T? -1	135. 135.	1.1 1.1			Warner, 15
446791 1998 <i>SJ</i> ₇₀	T0 0	19.15	0.90			Pravec, 14
446804 1999 <i>VN</i> ₆	NAT0 0	24.1	0.7			Pravec, 14
455192 2000 <i>QN</i> ₁₃₀	NT0 0	30.33	0.3			Pravec, 14
456051 2006 <i>AW</i>	T0 0	53.19 53.19	0.95 0.95			Warner, 16
464798* 2004 <i>JX</i> ₂₀	-2	36.	0.38			Warner, 16
467317* 2000 <i>QW</i> ₇	NT? -1	71.3 71.3	1.0 1.0			Pravec, 00w
467336* 2002 <i>LT</i> ₃₈	T? -1	21.80 21.80	1.16 1.16			Warner, 17

NON-PRINCIPAL AXIS ROTATION (TUMBLING) ASTEROIDS

Asteroid	PAR	Per ₁	Amp ₁	Per ₂	Amp ₂	Reference
468738* 2010 <i>TN</i> ₅₄	AT0 0	12.12	0.07			Pravec, 14
470510* 2008 <i>CJ</i> ₁₁₆	T0 0	32.26 32.26	1.00 1.00			Warner, 17
474158* 1999 <i>FA</i>	T- +2	10.092 10.092	1.2 1.2			Pravec, 05
477762* 2010 <i>XZ</i> ₆₇	T? 0	15.04 15.04	0.21 0.21	30.76	0.20	Warner, 14

F o o t n o t e. This Table includes data for the asteroids for which non-principal axis rotational motion (tumbling) has been reported (symbols *T* or *T?* in the column “Note” of the Table “Lightcurve parameters”). In some cases the Table contains data for asteroids not marked by symbol *T* or *T?* in the main table.

For each object the Table contains a summary line (the first one) and associated detail line(s). In the summary line the adopted value of primary period (Per₁) in hours and amplitude of brightness variation (Amp₁) are given.

In detail entries in the column PAR the non-principal axis rotation probability rating is given (see below description). Then alternative values of primary period and amplitude of brightness variation as well as values of secondary period (Per₂) and corresponding amplitude (Amp₂), if available, are cited. In the last column of detail entries short references to the principal author (name and year of corresponding publication) are printed. Posting on a web site are given as the current year + “*w*” (e. g., Warner, 11w).

An asterisk (*) between the asteroid number and name denotes a new or significantly changed entry.

PAR rating

The PAR rating is that used by Pravec et al, (2005) Icarus 173, 108–131.

Those asteroids where we believe the claims of NPA rotation are not justified are not included in the NPA rotation table, nor are they given as an entry in the “Note” column of the “Lightcurve parameters” Table. Following is a brief description of the PAR rating codes (see the Pravec et al. paper for a more detailed explanation):

- 4 Physical model of the NPA rotation constructed.
- 3 NPA rotation reliably detected with the two periods resolved. There may be some ambiguities in one or both periods.
- 2 NPA rotation detected based on deviations from a single period but the second period is not resolved.
- 1 NPA rotation possible, i. e., deviations from a single period are seen, but not conclusively.
- 0 Insufficient data to determine if rotation is PA or NPA.
- +1 PA rotation is consistent with the data but coverage is insufficient.
- +2 PA rotation likely, or deviations from PA are small with some overlapping data fitting a PA rotation period.
- +3 PA rotation quite likely.
- +4 PA spin vector obtained.

Entries with positive ratings are rare. Such ratings are used when the asteroid was thought to be tumbling but further examination showed it was likely in PA rotation, or when the damping time to PA rotation is sufficiently long that the given asteroid would more likely be in NPA than PA rotation.

Summary line usually contains letter *T* in PAR column with flag that currently has five possible qualifiers:

Blank The asteroid has a PAR < -1, i. e., it is definitely tumbling. Example: *T*

? Possible tumbler. There is some evidence that the asteroid might be a tumbler. It may carry a PAR = 0 to -1. Example: *T?*

0 The tumbling damping time scale (see Pravec 2005, Icarus) is long enough that tumbling might be expected, but observations are not sufficient to substantiate either tumbling or not tumbling, PAR = 0. Example: *T0*

- The tumbling damping time scale is long enough that tumbling might be expected, but observations indicate that the object is NOT tumbling, i. e., PAR >= 1. Example: *T-*

+ The tumbling damping time scale is short enough that tumbling would not seem likely, however observations indicate that it may be tumbling or actually is tumbling. PAR =< 0. Example: *T+*

The *W* flag denotes that result based on wide field data. The *W* flag is included so that those doing statistical studies can include or exclude the results from these surveys. Such surveys can introduce significant biases by “cherry picking” the best results from a large pool and so skew overall rotational statistics. See the paper by Warner, B. D. and Harris, A. W. (2011) “Using sparse photometric data sets for asteroid lightcurve studies.” Icarus, 216, 610–624.