

NON-PRINCIPAL AXIS ROTATION (TUMBLING) ASTEROIDS

Asteroid	PAR	Per <sub>1</sub>	Amp <sub>1</sub>	Per <sub>2</sub>	Amp <sub>2</sub>	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	T- 0 +2	272.9 274. 272.9	0.50 0.39 0.47			Pilcher, 14 Pilcher, 17
319 Leona	T -2	430. 430.	0.5 0.5	1084.		Pilcher, 17
341 California	T -2 -1 -2	318. 318. 317.0 317.0	0.92 0.9 0.92 0.54	250.		Pilcher, 17 Polakis, 17 Polakis, 17
384* Burdigala	T0 0 -1	404.9 404.9 399.8	0.40 0.40 0.36			Pilcher, 19 Polakis, 19
408 Fama	T0 0	202.1 202.1	0.58 0.58			Stephens, 08
437 Rhodia	T -2	433.2 433.2	0.35 0.35			Pilcher, 18
470* Kilia	T0 0 0	290. 290.	0.26 0.26			Stephens, 09 Stephens, 09
496 Gryphia	T -2	1072. 1072.	1.25 1.25			Pilcher, 17
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
703 Noëmi	T? -2 -1 0	200. 200. 201.7 115.108	0.78 0.62 0.78 0.28			Franco, 17 Noschese, 17 Sada, 17
707 Steina	T0 0	414.	1.00			Pravec, 14
722* Frieda	T? -1	131.1 131.1	0.45 0.45			Polakis, 19
763 Cupido	T -2 -1	151.5 151.5 151.1	0.45 0.45 0.24	101.		Pilcher, 18 Polakis, 18
821 Fanny	T0 0 0 -1	236.6 230.6 236.6 238.9	0.28 0.28 0.22 0.24			Pilcher, 18 Pilcher, 18 Polakis, 18
823 Sisigambis	T0 0	146.	0.7			Pravec, 14
824 Anastasia	T- +2 +2	250. 250.	1.20 1.20			Stephens, 10 Pravec, 14
831 Stateira	T0 0	861. 861.	0.64 0.64			Polakis, 19
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			Benisek, 14 Stephens, 14
1042 Amazone	T0 0	540.	0.25			Pravec, 14

## NON-PRINCIPAL AXIS ROTATION (TUMBLING) ASTEROIDS

Asteroid	PAR	Per <sub>1</sub>	Amp <sub>1</sub>	Per <sub>2</sub>	Amp <sub>2</sub>	Reference
1144 Oda	T -2	648. 648.	0.55 0.55	533.	0.55	Pilcher, 18
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
1255 Schilowa	T0 0	29.536 76.275	0.26 0.26			Polakis, 18
1264 Letaba	T? -1	32.74 63.74	0.28 0.13			Oey, 17
1278 Kenya	T -2	188. 188.	0.75 0.75	127.		Oey, 12
1329 Eliane	T? -1	137.8 137.8	0.43 0.43			Polakis, 18
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
1455* Mitchella	T? -1	118.7 118.7	0.60 0.60			Higgins, 11w
1473 Ounas	T+ -1 -2 -2	139.1 139.1 139.1	0.6 0.57 0.6			Behrend, 13w Pilcher, 13 Pravec, 14
1475* Yalta	T? -1	70.77 70.77	0.59 0.59			Polakis, 19
1479 Inkeri	T -2	660. 660.	1.30 1.3			Ferrero, 12
1481* Tübingia	T? 0	225.6 225.6	0.63 0.63			Polakis, 20
1483 Hakoila	T? -1	239.1 239.1	0.62 0.62			Polakis, 19
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
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
1707* Chantal	T -2	79.74 79.74	0.85 0.85			Polakis, 19
1720* Niels	T? -1	250.9 250.9	0.61 0.61			Polakis, 19
1744* Harriet	T0 0	719.5 719.5	1.10 1.10			Pilcher, 19
1750 Eckert	T -2	375. 375.	0.87 0.87			Warner, 10
1775 Zimmerwald	T -1	122. 122.	0.6 0.60			Stephens, 11

NON-PRINCIPAL AXIS ROTATION (TUMBLING) ASTEROIDS

Asteroid	PAR	Per <sub>1</sub>	Amp <sub>1</sub>	Per <sub>2</sub>	Amp <sub>2</sub>	Reference
1807 Slovakia	T0 0	308.6	1.10			Pravec, 14
1839 Ragazza	T -2	210.9 210.9	0.99 0.99			Polakis, 19
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 -2 -2	133.6 130. 133.6 138.2	1.16 1.16 1.10 1.09	344.	1.1	Warner, 11 Pravec, 14 Pilcher, 20 Polakis, 20
2035 Stearns	T -2	93. 93.	0.7 0.63			Stephens, 14
2045 Peking	T -2	82.4 82.4	0.8 0.8			Stephens, 17
2056 Nancy	T- 0	1343. 1343.	0.68 0.68			Polakis, 19
2062 Aten	T0 0	42.15	0.26			Pravec, 14
2389* Dibaj	T? -1	209.3 209.3	0.65 0.65			Polakis, 20
2423 Ibarruri	T- +1 +1	139.79 139.79	0.74 0.74			Pravec, 11w Pravec, 14
2430 Bruce Helin	T0 0	128.	0.67			Pravec, 14
2437 Amnestia	T0 0	85.	0.45			Pravec, 14
2440 Educatio	T0 0	1561. 1561.	0.80 0.80			Rowe, 18
2487 Juhani	T? 0	344.6 344.6	1.03 1.03			Polakis, 19
2554 Skiff	T? -1	273. 273.	0.9 0.9			Skiff, 17w
2639 Planman	T0 0	89.5	0.40			Pravec, 14
2672 Písek	T? -1	831. 831.	0.90 0.90			Benishek, 18
2675 Tolkien	T? 0 -1	1060. 1060.	0.75 0.75			Durkee, 11 Pravec, 14
2678 Aavasaksa	T? -1 0	82.2 82.2 124.	1.30 1.21 1.30			Rowe, 19 Zeigler, 19
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
2733 Hamina	T? 0 -1	93.23 93.46 93.23	0.48 0.48 0.36			Pravec, 17w Sada, 18
2735 Ellen	T0 0	159.	1.50			Pravec, 14
2772 Dugan	T0 0	235. 235.	1.14 1.14			Pravec, 12w

NON-PRINCIPAL AXIS ROTATION (TUMBLING) ASTEROIDS

Asteroid	PAR	Per <sub>1</sub>	Amp <sub>1</sub>	Per <sub>2</sub>	Amp <sub>2</sub>	Reference
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
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
3160 Angerhofer	T? -1	44.720 44.720	0.32 0.32			Stephens, 18
3233 Krišbarons	T0 0	888. 888.	1.44 1.44			Rowe, 18
3288 Seleucus	T -1 -2	75. 75. 75.	1.0 1.0 1.0			Harris, 99 Pravec, 05
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
3679 Condruses	T0 0	172. 172.3	1.30 1.20			Hills, 17
3691 Bede	T -2 -2	226.8 226.8 227.	0.5 0.5 0.5			Pravec, 98 Pravec, 05
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 -1	276. 140. 276.	0.60 0.60 0.52			Warner, 09 Polakis, 18
4179 Toutatis	T -2 +2 -2 -4	176. 130. 180. 176.	1.46 0.5 1.1 1.0 1.2	130.		Hudson, 95 Spencer, 95 Nakamura, 98 Pravec, 05
4181* Kivi	T0 -1 0	178.2 178. 178.2	0.78 0.77 0.78			Rowe, 19 Rowe, 19
4232 Aparicio	T0 0	54.4	0.83			Pravec, 14

## NON-PRINCIPAL AXIS ROTATION (TUMBLING) ASTEROIDS

Asteroid	PAR	Per <sub>1</sub>	Amp <sub>1</sub>	Per <sub>2</sub>	Amp <sub>2</sub>	Reference
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
4635* Rimbaud	T- +2	117.91 117.91	1.08 1.08			Stephens, 19
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
4690 Strasbourg	T -2	69.2 69.2	0.80 0.75	52.05		Warner, 11
4718 Araki	B?T? 0	46.35 46.35	0.16 0.16	19.373	0.10	Pravec, 17w
4748* Tokiwagozen	T+ -1	39.78 39.78	0.42 0.42			Marchini, 19
4750 Mukai	T? -1	38.3 38.3	0.40 0.40	24.		Pravec, 17w
4902 Thessandrus	T -2	738. 738.	0.60 0.60			French, 13
4947* Ninkasi	T -2	21.1 21.1	2.23 2.23	27.1	2.23	Pravec, 19w
4951* Iwamoto	T0 0	118.0 118.0	0.38 0.34			Pravec, 07w
5075* Goryachev	AT0 0	373. 373.	1.0 1.0			Pravec, 19w
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	81.5 81.5	1.5 1.5	62.85		Pravec, 06w Pravec, 14
5378 Ellyett	T+ -2 -2	47.32 47.32	0.48 0.48			Warner, 12 Pravec, 14
5390 Huichiming	T0 0	111.	0.75			Pravec, 14
5511 Cloanthus	T0 0	336.	0.49			Pravec, 14
5518 Mariobotta	T0 0	108.60 108.60	0.56 0.54			Pravec, 18w
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

NON-PRINCIPAL AXIS ROTATION (TUMBLING) ASTEROIDS

Asteroid	PAR	Per <sub>1</sub>	Amp <sub>1</sub>	Per <sub>2</sub>	Amp <sub>2</sub>	Reference
5691 Fredwatson	T0 0	106.0	1.2			Pravec, 14
5751 Zao	T0 0	76.	0.2			Pravec, 14
5752 1992 <i>CJ</i>	T0 0	86.	0.80			Pravec, 14
5774 Ratliff	T0 0	61.	0.6			Pravec, 14
5786* Talos	T? 0 -1	23.60 23.60	0.30 0.30			Pravec, 14 Warner, 20
5851 Inagawa	T? -1	367.5	0.90			Pravec, 14
5887 Yauza	T? -1	54.78 54.78	0.30 0.30	25.2		Pravec, 17w
5967 Edithlevy	T -2	66. 66.	0.7 0.7			Warner, 10
6063 Jason	T -2 -1	48.6 51.7 48.6	0.12 0.11 0.12	238. 682.0	0.12 0.25	Warner, 14 Warner, 17
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 0.22 0.13			Warner, 11 Warner, 11w Pravec, 14
6425 1994 <i>WZ</i> <sub>3</sub>	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			
6485 Wendeesther	T0 0	75.56	1.13			Pravec, 14
6487 Tonyspear	T- +2	74.91	1.24			Pravec, 14
6498 Ko	T0 0	500.	0.6			Pravec, 14
6779 Perrine	T? -1	72.279 72.279	1.16 1.16			Hills, 18
6911 Nancygreen	T0 0	54.7	0.75			Pravec, 14
7326* Tedbunch	T -2	76.40 76.40	0.46 0.46			Pravec, 19w
7352 1994 <i>CO</i>	T -2	648. 648.	0.30 0.30			Stephens, 14
7395* 1985 <i>RP</i> <sub>1</sub>	T -2	64.8 64.8	0.71 0.71	47.9	0.71	Pravec, 19w
7421 Kusaka	T -2	96.5 96.5	0.70 0.7			Galad, 10
7430 Kogure	T -1	335.9 335.9	0.57 0.57			Polakis, 18
7480 Norwan	T0 0	35.90	0.5			Pravec, 14
7509 Gamzatov	T0 0 0	249. 249. 249.1	0.75 0.75 0.75			Pravec, 17w Benishek, 18

NON-PRINCIPAL AXIS ROTATION (TUMBLING) ASTEROIDS

Asteroid	PAR	Per <sub>1</sub>	Amp <sub>1</sub>	Per <sub>2</sub>	Amp <sub>2</sub>	Reference
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	75.30	0.37			Pravec, 14
7954* Kitao	T -2	129.5 129.5	0.78 0.78			Rowe, 19
8026* Johnmckay	T0 0	372. 372.	1.00 1.00			Warner, 11
8130 Seeberg	T? 0 0	38.10 38.10 35.1	0.42 0.23 0.42			Warner, 17 Warner, 17
8141* Nikolaev	T0 0	366.9 366.9	0.69 0.69			Polakis, 20
8709 Kadlu	T- +1	50.6	0.40			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 <sub>1</sub>	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	T? 0 -1	19.164 19.164	1.13 1.13			Pravec, 14 Pravec, 19w
10531 1991 GB <sub>1</sub>	T0 0	55.1	0.21			Pravec, 14
10772 1990 YM	T? -1 -1	68.98 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	445.732 515.	0.7 0.53			French, 13
11398 1998 YP <sub>11</sub>	T- +2 0	38.60 38.60 38.59	0.46 0.25 0.20			Pravec, 05 Warner, 17
11500 Tomaiyowit	NT0 0	73.0	0.5			Pravec, 14
11579 Tsujitsuka	T? -1	56.6 56.6	1.19 0.8	24.		Pravec, 15w
11780 Thunder Bay	T0 0	295.	0.70			Pravec, 14
11789 Kempowski	AT0 0	48.6	0.48			Pravec, 14
12237 Coughlin	T0 0	80.4 80.4	1.62 1.62			Rowe, 19

NON-PRINCIPAL AXIS ROTATION (TUMBLING) ASTEROIDS

Asteroid	PAR	Per <sub>1</sub>	Amp <sub>1</sub>	Per <sub>2</sub>	Amp <sub>2</sub>	Reference
12265 1990 <i>FG</i>	T- +2 +2	56.6 56.6	0.65 0.65			Warner, 11 Pravec, 14
12538* 1998 <i>OH</i>	T? -2	2.575 2.5262	0.28 0.11	2.4680	0.11	Warner, 19
13331 1998 <i>SU</i> <sub>52</sub>	T? -1	375.	0.80			Pravec, 14
13553 <i>Masaakikoyama</i>	T -2 -2	58. 38. 58.	1.1 1.1 0.75	32.	0.75	Pravec, 05w Warner, 19
13643 <i>Takushi</i>	T0 0	83.838 83.838	1.00 1.00			Clark, 13
13651 1997 <i>BR</i>	T -1 -2	33.644 33.644 33.64	1.2 1.2 1.2			Pravec, 98 Pravec, 05
14040 <i>Andrejka</i>	T0 0	310.	0.95			Pravec, 14
14395 <i>Tommorgan</i>	T -2	35.5 35.5	0.61 0.61	40.4		Warner, 13
14764 <i>Kilauea</i>	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 <i>Rutberg</i>	T0 0	150.	1.0			Pravec, 14
15231 <i>Ehdita</i>	T+ -1	40.0 40.0	0.72 0.72			Warner, 19
15533 2000 <i>AP</i> <sub>138</sub>	T0 0	114.	0.38			Pravec, 14
15977 1998 <i>MA</i> <sub>11</sub>	T? -1	250. 250.	0.30 0.30			Stephens, 16
16064 <i>Davidharvey</i>	T -2	178.5 178.5	0.7 0.7			Pravec, 05
16198* <i>Búzios</i>	T? -1	103.6 103.6	1.06 1.06			Rowe, 19
16256 2000 <i>JM</i> <sub>2</sub>	T0 0	63.5 63.5	0.98 0.98			Warner, 12
16421 <i>Roadrunner</i>	T0 0 0	174. 173. 174.	1.25 1.25 1.00			Warner, 12 Warner, 14
16558 1991 <i>VQ</i> <sub>2</sub>	T0 0	170.	1.0			Pravec, 14
16589 <i>Hastrup</i>	T -2	128. 128.	0.62 0.62			Warner, 12
16641 <i>Esteban</i>	0	79.62 79.51	1.42 1.42			Pravec, 14w
16666* <i>Liroma</i>	T -2	79. 79.	0.51 0.51	108.	0.51	Pravec, 19w
16843 1997 <i>XX</i> <sub>3</sub>	T? -1	275. 275.	0.41 0.41			Warner, 17
16896 1998 <i>DS</i> <sub>9</sub>	T? -1	708. 708.	0.43 0.43			Stephens, 14
17584 1994 <i>XF</i> <sub>1</sub>	T -2 -2	4.6392 4.6398 4.6392	0.56 0.56 0.35	5.7306		Pravec, 15w Oey, 17
17681 <i>Tweedledum</i>	T0 0	75.2	0.90			Pravec, 14
18096 2000 <i>LM</i> <sub>16</sub>	T0 0	86.	0.18			Pravec, 14
18582 1997 <i>XK</i> <sub>9</sub>	T0 0	114.	0.94			Pravec, 14
18906 2000 <i>OJ</i> <sub>19</sub>	T0 0	77.90	0.80			Pravec, 14
19034 <i>Santorini</i>	T0 0	247. 247.	0.43 0.43			Warner, 17
19537 1999 <i>JL</i> <sub>8</sub>	AT0 0	50.1	0.10			Pravec, 14



NON-PRINCIPAL AXIS ROTATION (TUMBLING) ASTEROIDS

Asteroid	PAR	Per <sub>1</sub>	Amp <sub>1</sub>	Per <sub>2</sub>	Amp <sub>2</sub>	Reference
19711 Johnaligawesa	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 <i>NF</i> <sub>5</sub>	NT0 0	59.3	0.80			Pravec, 14
20231 1997 <i>YK</i>	T? 0 0	178. 178.	0.70 0.4 0.70			Warner, 09 Warner, 14
20562* 1999 <i>RV</i> <sub>120</sub>	T0 0	135.4 135.4	0.48 0.43			Pravec, 14w
20571 Tiamorrison	T0 0	450.	0.60			Pravec, 14
20628 1999 <i>TS</i> <sub>40</sub>	T? -1	68.1 68.1	1.04 1.04			Warner, 18
20996 1986 <i>PB</i>	T0 0	43.6	0.4			Pravec, 14
21609 Williamcaleb	T0 0	112.	0.5			Pravec, 14
22166 2000 <i>WX</i> <sub>154</sub>	T0 0	800. 800.	0.46 0.46			Pravec, 11w
22357 1992 <i>YJ</i>	T0 0	103. 103.	0.54 0.54			Warner, 11
23297* 2001 <i>AX</i> <sub>3</sub>	T -2	330. 330.	0.80 0.8	245.	0.8	Pravec, 19w
24077 1999 <i>TD</i> <sub>233</sub>	T -2	30.86 30.86	1.61 1.61	33.13		Warner, 14
24242 1999 <i>XY</i> <sub>100</sub>	T+ -2 -2	49.94 49.94	0.6 0.6			Pravec, 08w Pravec, 14
24702 1991 <i>OR</i>	T0 0	59.5	0.19			Pravec, 14
25076 1998 <i>QM</i> <sub>98</sub>	T -2	58.3 58.3	0.35 0.35			Warner, 15
25143 Itokawa	T- +4	12.132	1.45			Pravec, 05
25320 1999 <i>CP</i> <sub>15</sub>	T0 0	55.25 55.25	0.71 0.71			Stephens, 17
27810 Daveturner	T0 0	546. 546.	0.43 0.43			Warner, 11
28017 1997 <i>YV</i> <sub>13</sub>	T? -1 -1	47. 47.	0.15 0.15		0.15	Pravec, 05w Pravec, 14
29147 1988 <i>GG</i>	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 <i>CJ</i> <sub>50</sub>	T0 0	63.50	0.58			Pravec, 14
31013 1996 <i>DR</i>	T0 0	280. 280.	0.5 0.5			Pravec, 16w
31076 1996 <i>XH</i> <sub>1</sub>	AT0 0	350.	0.17			Pravec, 14
31173 1997 <i>XF</i> <sub>1</sub>	T0 0	122.8 122.8	0.67 0.67			Warner, 14
31182 1997 <i>YZ</i> <sub>3</sub>	T0 0	380.	0.90			Pravec, 14
31832 2000 <i>AP</i> <sub>59</sub>	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

NON-PRINCIPAL AXIS ROTATION (TUMBLING) ASTEROIDS

Asteroid	PAR	Per <sub>1</sub>	Amp <sub>1</sub>	Per <sub>2</sub>	Amp <sub>2</sub>	Reference
33341 1998 WA <sub>5</sub>	T- +1	204. 204.	0.57 0.57			Warner, 10
33356 1999 AM <sub>3</sub>	T- +2	37.59 37.59	0.92 0.92			Warner, 12
33736 1999 NY <sub>36</sub>	T? -1	211. 211.	0.4 0.4			Stephens, 12
33816 2000 AL <sub>42</sub>	AT0 0	193.	0.12			Pravec, 14
35259 1996 HN <sub>24</sub>	T0 0	230. 230.	0.45 0.45			Pravec, 16w
36298 2000 JF <sub>10</sub>	T? -1	82. 82.	0.75 0.75			Warner, 10
36316 2000 LC <sub>12</sub>	T -2	56.5 56.5	1.22 1.22	46.4		Warner, 12
37586* 1991 BP <sub>2</sub>	T? 0	887. 900.	0.96 0.96			Pravec, 16w
37634 1993 UZ	T0 0	82.0 82.0	0.70 0.70			Warner, 10
37635 1993 UJ <sub>1</sub>	T0 0	600.	0.8			Pravec, 14
38063 1999 FH	T? -1	990. 990.	0.55 0.55			Stephens, 15
38071 1999 GU <sub>3</sub>	T? -1 -1	216. 216. 215.	1.50 1.4 1.5			Pravec, 00 Pravec, 02w
39240 2000 YZ <sub>69</sub>	T0 0	105.	1.6			Pravec, 14
39420 Elizabethgaskell	T0 0	105.	1.6			Pravec, 14
39618 1994 LT	T -2	140. 140.	0.85 0.85			Warner, 12
39796 1997 TD	T? -1	223.5 223.5	0.92 0.92			Warner, 15
41424 2000 CK <sub>40</sub>	T0 0	48.0	0.35			Pravec, 14
41503 2000 QG <sub>148</sub>	T0 0	42.81 42.81	1.00 1.00			Warner, 14
41660 2000 SV <sub>362</sub>	T0 0	77.2 77.2	0.65 0.65			Stephens, 14
42286 2001 TN <sub>41</sub>	T- 0	77.9 77.9	0.44 0.44			Warner, 17
42843 1999 RV <sub>11</sub>	T -2	894. 894.	1.32 1.32	24.		Pravec, 17w
43606 2001 XQ <sub>2</sub>	T? -1	87. 87.	1.3 1.3			Warner, 10
44534 1998 YZ <sub>9</sub>	ADT0 T0	45.0	0.75			Pravec, 14
48707 1996 KR <sub>1</sub>	T0 0	230.	0.75			Pravec, 14
51371 2000 XF <sub>15</sub>	AT0 0	54.	0.09			Pravec, 14
51386 2001 CN <sub>35</sub>	T0 0	48.0	0.36			Pravec, 14
52387 Huitzilopochtli	T0 0	26.	0.4			Pravec, 14
53008 1998 VY <sub>5</sub>	0	47. 47.	0.30 0.3			Pravec, 13w
53319 1999 JM <sub>8</sub>	T -2	136. 136.	0.7 0.7			Pravec, 05
53789 2000 ED <sub>104</sub>	NT0 0	43.	1.1			Pravec, 14
54071 2000 GQ <sub>146</sub>	NT0 0	51.	0.2			Pravec, 14

NON-PRINCIPAL AXIS ROTATION (TUMBLING) ASTEROIDS

Asteroid	PAR	Per <sub>1</sub>	Amp <sub>1</sub>	Per <sub>2</sub>	Amp <sub>2</sub>	Reference
54789 2001 <i>MZ</i> <sub>7</sub>	T+ -3 -3	37.57 37.57	1.4 1.4	52.79		Pravec, 05 Pravec, 14
55532 2001 <i>WG</i> <sub>2</sub>	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> <sub>5</sub>	T0 0	57.4	0.90			Pravec, 14
64107 2001 <i>TK</i> <sub>8</sub>	T? -1	68.5 68.5	1.31 1.31			Warner, 15
65407 2002 <i>RP</i> <sub>120</sub>	T0 0	200.	0.6			Pravec, 14
65637 Tsniimash	T -1	220. 220.	0.90 0.90			Stephens, 14
65717 1993 <i>BX</i> <sub>3</sub>	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> <sub>13</sub>	+2	56.71 56.71	0.80 0.80			Alvarez, 13
68547 2001 <i>XW</i> <sub>29</sub>	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> <sub>1</sub>	T0 0	46.1	0.23			Pravec, 14
76800 2000 <i>OQ</i> <sub>35</sub>	T0 0	392.	1.4			Pravec, 14
79316 Huangshan	T? -1	493. 493.	0.62 0.62			Stephens, 15
85774* 1998 <i>UT</i> <sub>18</sub>	T? -1 -1	55. 55. 55.	0.86 0.83 0.86	24. 24.	0.83 0.86	Pravec, 19w Pravec, 19w
85867 1999 <i>BY</i> <sub>9</sub>	T? -1	700. 700.	1.5 1.5			Skiff, 19
85953* 1999 <i>FK</i> <sub>21</sub>	T 0 -2 -2 -2	28.08 28.1 28.08 27.88 28.08	0.87 0.60 0.46 0.66 0.47	23.98 18.77 23.98	0.46 0.66 0.47	Skiff, 11w Warner, 18 Pravec, 19w Pravec, 19w
86039 1999 <i>NC</i> <sub>43</sub>	AT? -1	34.49 34.29	1.10 1.00			Warner, 14
86666 2000 <i>FL</i> <sub>10</sub>	T? -1	206. 206.	0.85 0.85			Warner, 16
88254* 2001 <i>FM</i> <sub>129</sub>	T -2	38.56 38.56	1.2 1.2			Warner, 19
89136 2001 <i>US</i> <sub>16</sub>	T -3	14.39 14.39	0.90 0.90	37.4		Pravec, 04w
89355 2001 <i>VS</i> <sub>78</sub>	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> <sub>118</sub>	T0 0	81.	0.74			Pravec, 14
99812 2002 <i>LW</i> <sub>31</sub>	T0 0	150.	0.8			Pravec, 14

NON-PRINCIPAL AXIS ROTATION (TUMBLING) ASTEROIDS

Asteroid	PAR	Per <sub>1</sub>	Amp <sub>1</sub>	Per <sub>2</sub>	Amp <sub>2</sub>	Reference
99942 Apophis	T -3 -3	30.56 30.56	1.14 1.14	27.38		Pravec, 14 Brozovic, 18
101430 1998 VE <sub>32</sub>	T0 0	40.66	0.22			Pravec, 14
101549 1998 YY <sub>29</sub>	T0 0	56.7 56.7	0.70 0.51			Warner, 09
105844 2000 SH <sub>160</sub>	T0 0	38.26	1.45			Pravec, 14
106620 2000 WL <sub>124</sub>	T- +2 +2	104.5 104.5	0.58 0.58			Warner, 12 Pravec, 14
120578 1995 QV <sub>12</sub>	T? 0	72.4 72.4	0.51 0.51			Warner, 14
121514 1999 UJ <sub>7</sub>	T? -1	46.46 46.46	0.65 0.65			Borisov, 18
122463 2000 QP <sub>148</sub>	T0 0	426. 426.	1.13 1.13			Pravec, 16w
123937 2001 EX <sub>16</sub>	T0 0	39.82	0.07			Pravec, 14
125742 2001 XT <sub>117</sub>	T? -1	60.8 60.8	1.40 1.15			Warner, 13
134422 1998 QM <sub>3</sub>	T -1	25.4 25.4	0.65 0.65	34.2	0.60	Warner, 15
134549 1999 RN <sub>154</sub>	T? -1	124. 124.	0.55 0.55			Warner, 14
135486 2001 XP <sub>2</sub>	T0 0	69.	1.2			Pravec, 14
141018 2001 WC <sub>47</sub>	T0 0	16.51 16.51	0.18 0.18			Warner, 12
143404 2003 BD <sub>44</sub>	T? -1 0 0	78.64 78.64 78.863 78.617	1.05 0.95 1.05 0.66			Warner, 17 Warner, 17 Sada, 18
143651* 2003 QO <sub>104</sub>	T? -1 -1 -1	114.4 114.4 114. 114.	1.60 1.60 1.25 1.25			Warner, 09 Koehn, 14 Skiff, 19
143678 2003 SA <sub>224</sub>	ANTO 0	35.	0.24			Pravec, 14
144411 2004 EW <sub>9</sub>	T- +2	49.94 49.94	1.9 0.9			Pravec, 04w
152664 1998 FW <sub>4</sub>	T0 0	17.38 17.38	0.34 0.34			Warner, 14
152679 1998 KU <sub>2</sub>	T -2	125. 125.	1.35 1.35			Warner, 16
154807 2004 PP <sub>97</sub>	T? -1	161. 161.	0.96 0.96			Warner, 16
162004* 1991 VE	T+ -2 -3	13.4895 13.4802 13.4895	1.12 1.08 1.12	17.316 17.318	1.12	Pravec, 12w Pravec, 19w
162058 1997 AE <sub>12</sub>	NT0 0	1880.	0.6			Pravec, 14
162416 2000 EH <sub>26</sub>	RT0 0	24.				Pravec, 14
162900 2001 HG <sub>31</sub>	T -3 -1	60.61 60.61 59.58	0.56 0.50 0.56	39.0		Pravec, 08w Warner, 09
162998 2001 SK <sub>162</sub>	NT0 0	68.	0.40			Pravec, 14
163081 2002 AG <sub>29</sub>	T0 0	19.640	0.38			Pravec, 14
163696 2003 EB <sub>50</sub>	T0 -1 0 -1	62.06 27.2 62.4 62.9	1.64 0.73 0.83 1.43	31.4		Warner, 14 Warner, 16 Warner, 17
163732 2003 KP <sub>2</sub>	NT? -1	151.1 151.1	1.7 1.7			Pravec, 03w

NON-PRINCIPAL AXIS ROTATION (TUMBLING) ASTEROIDS

Asteroid	PAR	Per <sub>1</sub>	Amp <sub>1</sub>	Per <sub>2</sub>	Amp <sub>2</sub>	Reference
163899 2003 <i>SD</i> <sub>220</sub>	T? -1	285. 285.	2.5 2.2			Warner, 16
164400 2005 <i>GN</i> <sub>59</sub>	T- 0 +1	38.69 38.69	1.30 1.30			Skiff, 12 Pravec, 14
168381 1997 <i>LY</i> <sub>4</sub>	T -2	46.07 46.07	1.0 1.0			Pravec, 00
179806 2002 <i>TD</i> <sub>66</sub>	T0 0	9.455	1.16			Pravec, 14
181882 1999 <i>RF</i> <sub>14</sub>	T? 0	2.5 2.5	0.20 0.20			Skiff, 11w
183581 2003 <i>SY</i> <sub>84</sub>	T? -1	260. 260.	0.87 0.87			Warner, 15
188077 2001 <i>XW</i> <sub>47</sub>	T0 0	525.	0.3			Pravec, 14
206378 2003 <i>RB</i>	T? 0 0	37.5 37.5	0.43 0.43			Pravec, 14 Warner, 16
214869 2007 <i>PA</i> <sub>8</sub>	T -3	102.24 102.24	0.58	493.		Brozovic, 17
217807 2000 <i>XK</i> <sub>44</sub>	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 <i>RL</i> <sub>66</sub>	B?T0 0 0	587. 590. 587.	0.32 0.32 0.25			Warner, 10 Warner, 10
232368 2003 <i>AZ</i> <sub>2</sub>	T? -1	31.1 31.1	0.96 0.96			Warner, 18
234145 2000 <i>EW</i> <sub>70</sub>	RT0 0	33.				Pravec, 14
242191 2003 <i>NZ</i> <sub>6</sub>	T0 0	13.531	1.5			Pravec, 14
243025* 2006 <i>UM</i> <sub>216</sub>	T -2	31.73 31.73	1.3 1.3			Warner, 20
244670* 2003 <i>KN</i> <sub>18</sub>	T -2	20.887 20.887	1.01 1.01	37.06	0.6	Warner, 19
253106 2002 <i>UR</i> <sub>3</sub>	T? -1	180. 180.	0.36 0.36			Warner, 16
267337 2001 <i>VK</i> <sub>5</sub>	T? -1	39.05 39.05	0.92 0.92			Warner, 14
267729 2003 <i>FC</i> <sub>5</sub>	NT0 0	129.5	0.5			Pravec, 14
275611* 1999 <i>XX</i> <sub>262</sub>	AT? -2 0	15.109 15.112 15.109	0.16 0.14 0.13	18.010	0.18	Warner, 19 Warner, 19
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
306381* 1993 <i>RR</i> <sub>2</sub>	T? -1	103.26 103.26	0.78 0.78			Pravec, 19w
306790 2001 <i>KB</i> <sub>1</sub>	T? -1	71. 71.	0.85 0.85			Warner, 15
308635 2005 <i>YU</i> <sub>55</sub>	AT0 -1 0	19.31	0.30			Muller, 13 Pravec, 14
326291* 1998 <i>HM</i> <sub>3</sub>	T? -1	7.908 7.908	0.35 0.35	6.299	0.08	Warner, 20
329770 2004 <i>JA</i>	NT0 0	52.1	0.4			Pravec, 14
331471 1984 <i>QY</i> <sub>1</sub>	T -2	45.5 45.5	0.65 0.65	36.6		Warner, 16
345853 2007 <i>PU</i> <sub>11</sub>	T0 0	56.8	0.98			Pravec, 14

NON-PRINCIPAL AXIS ROTATION (TUMBLING) ASTEROIDS

Asteroid	PAR	Per <sub>1</sub>	Amp <sub>1</sub>	Per <sub>2</sub>	Amp <sub>2</sub>	Reference
363084 2000 <i>RD</i> <sub>53</sub>	NT0 0	14.96	0.09			Pravec, 14
363505* 2003 <i>UC</i> <sub>20</sub>	T? -2	29.6 29.6	0.88 0.88			Pravec, 19w
367943* Duende	T -3 -2	8.724 8.724 8.71	1.79 1.7	6.359 23.7	1.7	Benson, 17 Moskovitz, 19
368664 2005 <i>JA</i> <sub>22</sub>	T? -1	31.7 31.7	0.92 0.92			Warner, 14
369984 1998 <i>QR</i> <sub>52</sub>	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> <sub>2</sub>	-1	2.425 1.704	0.57 0.2	94.	0.3	Vereshchagina, 09
380929 2006 <i>HU</i> <sub>30</sub>	T? -1	49.0 49.0	0.17 0.17	450.		Warner, 14
388945* 2008 <i>TZ</i> <sub>3</sub>	T -1 -2	39.15 44.2 39.15	0.56 0.56 0.49	52.4 34.11	0.49 0.49	Warner, 16 Pravec, 19w
398188 Agni	T -2	21.99 21.99	1.12 1.12			Warner, 15
411201 2010 <i>LJ</i> <sub>14</sub>	T0 0	113. 113.	0.85 0.85			Warner, 14
413260 2003 <i>TL</i> <sub>4</sub>	NT0 0	27.2	1.0			Pravec, 14
413577* 2005 <i>UL</i> <sub>5</sub>	T? -1	3.4590 3.4590	0.35 0.27	5.146	0.27	Pravec, 19w
415949 2001 <i>XY</i> <sub>10</sub>	T0 0	43.5 43.5	0.35 0.35			Warner, 15
416186 2002 <i>TD</i> <sub>60</sub>	T+ -3 -3 -4 -3	2.8513 2.8512 2.8516 2.8513 2.8504	2.0 2.0 1.5 1.4 1.15	6.784 6.784 6.781 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
422686* 2000 <i>AC</i> <sub>6</sub>	T -2	2.4437 2.4437	0.29 0.29	7.248	0.29	Pravec, 19w
429584 2011 <i>EU</i> <sub>29</sub>	T0 0	43.5 43.5	0.65 0.65			Warner, 15
433953* 1997 <i>XR</i> <sub>2</sub>	T -2	9.3205 9.3205	0.72 0.72			Pravec, 19w
443103 2013 <i>WT</i> <sub>67</sub>	T? -1	135. 135.	1.1 1.1			Warner, 15
444193 2005 <i>SE</i> <sub>71</sub>	T -2	66.8 66.8	0.8 0.8			Warner, 18
446791 1998 <i>SJ</i> <sub>70</sub>	T0 0	19.15	0.90			Pravec, 14
446804 1999 <i>VN</i> <sub>6</sub>	ANT0 0	24.1	0.7			Pravec, 14
455192 2000 <i>QN</i> <sub>130</sub>	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> <sub>20</sub>	T -2 -2	10.758 36. 10.758	0.50 0.38 0.50	9.24	0.50	Warner, 16 Skiff, 19w
467317* 2000 <i>QW</i> <sub>7</sub>	T -1 -2 -1	71.57 71.3 71.57 72.1	1.10 1.0 0.99 1.10	57.7	0.28	Pravec, 00 Pravec, 19w Warner, 20w
467336 2002 <i>LT</i> <sub>38</sub>	T? -1	21.80 21.80	1.16 1.16			Warner, 17
468738 2010 <i>TN</i> <sub>54</sub>	AT0 0	12.12	0.07			Pravec, 14

NON-PRINCIPAL AXIS ROTATION (TUMBLING) ASTEROIDS

Asteroid	PAR	Per <sub>1</sub>	Amp <sub>1</sub>	Per <sub>2</sub>	Amp <sub>2</sub>	Reference
470510 2008 <i>CJ</i> <sub>116</sub>	T0 0	32.26 32.26	1.12 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> <sub>67</sub>	T? 0	15.04 15.04	0.21 0.21	30.76	0.20	Warner, 14
483508* 2003 <i>CR</i> <sub>1</sub>	T -2	26.39 26.39	1.35 0.99	40.6	0.99	Pravec, 19w
490581 2009 <i>WZ</i> <sub>104</sub>	AT0 0	19.304	0.52			Pravec, 14
496817 1989 <i>VB</i>	T0 0	16.	0.32			Pravec, 14
497176 2004 <i>TQ</i> <sub>13</sub>	T0 0	60.52 60.52	0.63 0.63			Warner, 18
503941* 2003 <i>UV</i> <sub>11</sub>	T -3	18.25 29.89	0.55 0.55	46.38	0.55	Pravec, 19w
511137 2013 <i>XM</i> <sub>24</sub>	T -2	37.9 37.9	0.80 0.80	53.2		Warner, 15
515082 2010 <i>TM</i> <sub>3</sub>	0	0.043081 0.043081	0.55 0.55			Statler, 13
523811* 2008 <i>TQ</i> <sub>2</sub>	T -3	1.3549 1.3549	0.37 0.37	1.9497	0.37	Pravec, 20w
523826* 1990 <i>UP</i>	T0 0	20.	0.8			Pravec, 14
524196* 2001 <i>QP</i> <sub>181</sub>	T0 0	17.05	0.16			Pravec, 14
524471* 2002 <i>JW</i> <sub>15</sub>	T -2	11.489 11.489	0.45 0.42	8.91	0.42	Pravec, 19w
524522* 2002 <i>VE</i> <sub>68</sub>	T? 0 -1	13.50 13.36	1.22 1.22			Pravec, 14 Skiff, 19
524594* 2003 <i>NW</i> <sub>1</sub>	T -2	37.7 37.7	0.74 0.74	158.	0.9	Warner, 19
525477* 2005 <i>FC</i> <sub>3</sub>	T0 0	430. 430.	0.44 0.44			Pravec, 19w
528159* 2008 <i>HS</i> <sub>3</sub>	T -2 -2	10.68 10.75 10.60	0.94 0.17 0.30	17.60 13.47	0.17 0.26	Pravec, 19w Warner, 19
531899* 2013 <i>BE</i> <sub>19</sub>	T0 0	115.	0.40			Pravec, 14
537342* 2015 <i>KN</i> <sub>120</sub>	T -1 -3	9.090 46.3 9.090	0.59 0.59 0.44	9.107 14.15	0.34 0.44	Warner, 18 Pravec, 19w

**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 “Minor planet 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 (Per<sub>1</sub>) in hours and amplitude of brightness variation (Amp<sub>1</sub>) 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 (Per<sub>2</sub>) and corresponding amplitude (Amp<sub>2</sub>), 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 “Minor planet 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  $\text{PAR} < -1$ , 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  $\text{PAR} = 0$  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,  $\text{PAR} = 0$ . 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.,  $\text{PAR} \geq 1$ . 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.  $\text{PAR} \leq 0$ . Example: *T+*.