

MICROMETER MEASURES OF DOUBLE STARS

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Received 1998 April 13

ABSTRACT

Micrometer measures of 795 double stars made with the 26 inch (0.66 m) refractor of the US Naval Observatory from 1984 to 1990 are presented.

Key words: binaries: close — binaries: visual

This paper lists 844 means of 795 double stars made with the 26 inch (0.66 m) refractor of the US Naval Observatory by C. E. W. The 844 means are derived from 2934 measures, and each set of measures combined into a mean was obtained in the same observing season. The program has concentrated on close pairs exhibiting orbital motion. Other wide pairs are measured as time permits. These data were obtained from 1984 September 17 (1984.713) to 1990 May 13 (1990.366) and represent the last collection of visual micrometry data obtained with the 26 inch prior to the transition to a program of speckle interferometry (see Douglass, Hindsley, & Worley 1997). The measured separations range from 0^h:10 (21572 + 1047, Aitken 622) to 33^h:58 (14554 + 0647, John Herschel 1259), with a median separation of 0^h:98.

Table 1 presents the means for systems that do not have published orbits. The first two columns provide identifiers, the coordinates for J2000.0 and the discovery designation (see Worley & Douglass 1997). Column (3) provides the epoch of observation, expressed in fractional Besselian year. The position angle (θ) and separation (ρ) are given in columns (4) and (5). The measured position angles have not been corrected for precession and are thus based upon the equinox at the epoch of observation. Column (6) gives the estimated visual Δm , and the final column gives the number of measures (n) used to generate the mean. Table 2 provides these data for systems with published orbits. While many are found in Worley & Heintz (1983), this compilation of orbits is out of date and a new orbit catalog (Worley et al. 1998) is in progress. Additional information provided in Table 2 are the residuals to the published orbit ($O - C$), both in position angle (col. [8]) and in separation (col. [9]). The reference to the orbit is provided in column (10). Many of

these systems have multiple orbit calculations, and in all cases the orbit cited is the one with the better grade in the orbit catalog (Worley & Heintz 1983; Worley et al. 1998). If the different orbits have the same grade or it is not clear which is the better orbit, the one with the smaller residuals is provided in Table 2 with a note added to the table giving residuals for the alternate orbit calculation. These systems are noted in column (11). Systems with new orbit calculations in progress are also indicated in column (11).

The assessment of errors for measures of this type is exceedingly difficult. While evaluating them by considering the mean $O - C$ in θ and ρ for orbits is possible, the orbits themselves have some unknown error associated with them, and thus, the $O - C$ is a convolution of the orbit error and measurement error. The orbit catalogs (Worley & Heintz 1983; Worley et al. 1998) grade the orbits from “1” (definitive) to “5” (indeterminate). These grades consider many factors; among them are the fit of the data to the orbit, the coverage of critical phases, the consistency of the data, and the completeness of the phase coverage. So, it may be possible for an orbit to be considered indeterminate (grade 5) and still have low residuals in or give reasonable ephemerides for the short term. The mean $O - C$ values in both ρ and θ for these five grades, as well as the number of systems having that grade, are listed in Table 3. Orbits with grade 1 or 2 are probably unlikely to see significant change in their elements (if at all) and thus probably best represent cases where the $O - C$ value indicates the true measurement error. Therefore, an approximate error of 2^h:0 and 0^h:04 is assumed. However, it is these $O - C$ values for all orbit systems that, when considered with other contemporaneous data, can show periodic runoff in θ and/or ρ . These considerations led directly to the new orbit calculations of Mason & Hartkopf (1998) and others in progress, as indicated.

¹ Deceased 1997 December 31.

REFERENCES

- Arend, S. 1951, *Ann. Obs. R. Belgique*, 5, 161
———. 1953, *Bull. Astron. Obs. R. Belgique*, 4, 155
Baize, P. 1957, *J. Obs.*, 40, 197
———. 1958a, *J. Obs.*, 41, 163
Baize, P. 1958b, *J. Obs.*, 41, 177
———. 1969, *Circ. d'Inf.*, No. 48
———. 1974, *A&AS*, 13, 65
———. 1976, *A&AS*, 26, 177
Baize, P. 1980, *A&AS*, 39, 83
———. 1981, *A&AS*, 44, 199
———. 1983, *A&AS*, 51, 479
———. 1984, *A&AS*, 56, 103
———. 1986, *A&AS*, 65, 551
———. 1987, *A&AS*, 71, 177
———. 1989, *A&AS*, 78, 125
———. 1991, *A&AS*, 87, 49
———. 1992, *A&AS*, 92, 31
Baize, P. 1993, *A&AS*, 99, 205
———. 1994, *A&AS*, 106, 267
Batten, A. H., Fletcher, J. M., Fisher, W. A., McClure, R. D., Morbey, C. L., Griffin, R. F., & Scarfe, C. D. 1982, *PASP*, 94, 860
Brosche, P. 1957, *Astron. Nachr.*, 283, 280
Cester, B. 1991, *Circ. d'Inf.*, No. 113
Costa, J. M. 1978, *Circ. d'Inf.*, No. 75
Costa, J. M., & Docobo, J. A. 1982, *Circ. d'Inf.*, No. 87
———. 1983, *Circ. d'Inf.*, No. 89
Couteau, P. 1958, *J. Obs.*, 41, 95
———. 1960, *Bull. Astron. Paris*, 23, 127
———. 1984, *A&AS*, 57, 171
———. 1986, *A&AS*, 65, 505
———. 1987, *A&AS*, 71, 569
———. 1989, *A&AS*, 80, 373
———. 1990, *Circ. d'Inf.*, No. 111
da Silva, A. S., & Balca, M. C. 1968, *O Inst. Coimbra*, 131

TABLE 1
MICROMETER MEASUREMENTS OF DOUBLE STARS

Coordinates (J2000.0) (1)	Discoverer Designation (2)	Epoch (1900+) (3)	θ (deg) (4)	ρ (arcsec) (5)	Δm (mag) (6)	n (7)
00015+3044.....	Ho 208	88.915	198.8	1.10	1.8	4
00024+1047.....	A 1249	88.836	238.8	0.23	0.4	4
00028+0208.....	Bu 281	89.682	169.7	1.52	1.3	4
00048+4358.....	A 203	88.316	345.6	1.78	0.3	4
00049+4540.....	Bu 997	90.002	337.6	3.96	1.5	3
00076-0433.....	StF 3063	88.909	206.7	1.22	1.4	3
00149+2133.....	Bu 1027	88.787	191.9	1.69	3.0	4
00187+1559.....	StF 25	90.000	193.0	1.12	0.1	2
00192+5942.....	Kr 4	88.194	182.3	2.24	0.7	3
00216+4856.....	Hu 505	90.006	137.0	1.78	3.0	2
00240+0955.....	A 1805	89.625	316.0	4.73	2.7	3
00248+1925.....	Br 2296	88.898	189.4	3.02	0.3	3
00272+2115.....	Bu 1225	88.898	193.1	1.41	2.8	3
00287+2134.....	Hu 601	88.898	308.4	0.56	0.5	3
00318+2346.....	Cou 74	88.821	5.6	2.04	1.5	3
00344+1844.....	Cou 250	88.821	38.3	1.21	0.3	3
00395+0319.....	A 2203	88.318	118.4	2.53	0.6	4
00407+3707.....	Cou 852	89.942	248.7	0.91	0.4	3
00465+1558.....	Hei 19	89.911	243.8	0.60	0.4	2
00466+2013.....	A 2206	88.318	295.7	4.45	3.2	4
00470+2315.....	Hu 413	88.317	287.9	0.37	0.7	4
00535+0318.....	HdO 37	89.573	232.9	1.50	0.3	3
00554+3040.....	Bu 500	90.020	299.7	0.47	0.2	3
00557+1706.....	Hei 94	88.131	259.5	1.10	0.2	3
00591+0523.....	StF 78	88.252	244.4	4.94	0.2	3
00594+3746.....	Es 155	89.573	73.4	6.46	1.0	3
01058+2655.....	Br 121	90.006	193.2	2.72	0.5	2
01071+1133.....	Stt 22	89.573	201.0	8.48	3.2	3
01125+3747.....	Cou 1057	89.207	181.6	0.41	0.5	4
01177+5617.....	Leo 4	89.190	90.1	3.57	1.0	3
01194+4857.....	Hu 521	88.697	109.4	0.26	0.0	4
01226+1245.....	Bu 1360	89.730	26.7	5.58	2.0	4
01276+2104.....	Cou 148	88.921	248.6	1.16	0.3	4
01360+0739.....	StF 138	89.681	55.8	1.66	0.0	4
01377+1836.....	Cou 254	88.264	26.2	1.72	0.1	3
01379+2753.....	Mlb 516	89.937	245.4	1.78	1.1	3
01445+3957.....	StF 149	90.002	86.3	1.43	0.9	3
01467+3310.....	StF 158	89.573	272.2	2.13	0.4	3
01493+4754.....	StF 162 Aa-B	88.264	202.5	2.03	0.6	3
01513+6021.....	A 951	89.955	216.8	0.43	0.1	4
01535+4437.....	StF 3113	88.264	279.6	0.73	0.1	3
02215+0940.....	A 2217	88.879	80.0	2.90	3.3	3
02218+3830.....	Stt 40	90.046	48.4	0.62	0.4	2
02284+1722.....	A 2330	90.074	20.1	1.16	0.2	4
02291+2331.....	VBS 6	86.444	61.1	0.20	...	2
02291+2252.....	Hu 603	88.879	231.1	5.91	1.7	3
02317+0244.....	A 2333	88.88	216.3	0.27	...	2
02327+0620.....	StF 276	89.160	271.2	2.01	0.0	4
02388+3325.....	StF 285	89.495	165.6	1.70	0.6	4
02471+3533.....	Bu 9	89.495	200.0	1.31	1.5	4
02558+1909.....	A 2342	90.032	23.3	0.40	0.8	3
02592+2120.....	StF 333	89.734	209.0	1.45	0.2	6
02594+0639.....	StF 334	89.100	311.0	1.18	0.6	4
03027-0741.....	Bu 11	90.106	66.3	1.53	3.0	2
03096+6141.....	Mlb 157	90.032	228.1	2.82	2.5	3
03158+5057.....	Hu 544	90.074	103.2	1.47	1.6	4
03163+1920.....	A 2224	90.110	335.0	0.98	1.3	3
03216+2145.....	Hu 434	89.554	206.6	0.32	0.4	4
03217+0845.....	StF 380	90.110	20.4	0.93	0.9	3
03261+2015.....	A 2344	90.022	192.8	1.24	0.7	4
03282+0409.....	A 2417 BC	90.098	122.6	0.76	0.9	4
03286+2904.....	StF 395	90.022	91.6	1.86	1.1	4
03307-0416.....	StF 408	90.049	324.6	1.22	0.1	4
03354+3529.....	Pop 83	90.103	269.8	0.55	0.4	4
03356+3141.....	Bu 533	90.074	43.4	1.05	0.1	4
03365+1011.....	A 830	89.573	6.8	0.38	0.2	4
03370+1632.....	Hei 29	89.329	78.5	0.70	0.7	4
03446+3210.....	Bu 880	90.110	15.0	0.56	0.3	3
03450+0819.....	A 1827	90.103	21.0	3.79	1.3	4
03483+2223.....	Bu 1183	88.767	272.2	0.47	0.5	3
03489+1143.....	A 831	90.098	20.2	0.30	0.7	4
03490+1459.....	Ho 324	90.032	331.7	1.16	0.2	3
03514+2538.....	Hei 9	90.064	282.8	4.31	1.1	3
03521+4048.....	Stt 66	90.112	143.1	0.96	0.6	2
03578+2255.....	Cou 364	88.767	146.2	2.46	1.9	3

TABLE 1—Continued

Coordinates (J2000.0) (1)	Discoverer Designation (2)	Epoch (1900+) (3)	θ (deg) (4)	ρ (arcsec) (5)	Δm (mag) (6)	n (7)
03578 + 1856.....	Hld 69	90.098	197.1	2.24	0.5	4
03590 + 0947.....	Hu 27	88.860	304.1	0.28	0.2	4
03594 + 4321.....	A 1708	90.098	339.4	0.76	0.4	4
03598 + 2848.....	A 465	89.398	203.8	1.92	1.6	3
04038 + 2824.....	Cou 701	90.098	210.9	1.63	0.7	4
04057 + 2248.....	Cou 151	88.110	260.0	0.36	0.2	3
04186 + 6030.....	Stt 75	90.108	178.5	0.38	0.2	4
04187 + 0445.....	A 1939	88.438	288.5	0.66	1.6	3
04206 + 2430.....	Cou 704	88.854	263.8	1.99	0.2	4
04245 + 2244.....	Bu 1235	89.096	60.7	0.32	0.0	3
		90.028	63.7	0.32	0.0	3
04287 + 5355.....	Bu 745	90.100	109.4	0.35	0.1	4
04290 + 5659.....	Mlb 118	90.100	156.4	6.74	0.8	4
04307 + 3041.....	Kui 18	89.320	66.4	1.44	0.4	4
04366 + 1946.....	Stt 86	88.159	13.4	0.48	0.0	4
04367 + 1930.....	StF 567	88.159	340.0	2.03	0.3	3
04389 + 0011.....	A 839	89.105	301.6	2.18	3.6	4
04465 + 5507.....	Hu 552	90.108	241.6	1.32	0.7	4
04471 + 1003.....	A 2037	89.072	86.6	3.25	4.0	5
04476 + 2211.....	Hu 443	90.074	293.1	0.45	0.5	4
04523 + 0541.....	A 1943	90.032	235.6	2.30	2.2	3
04528 - 0517.....	Bu 316	90.130	181.7	0.91	0.1	4
04539 + 5603.....	Hu 818	90.108	79.7	0.35	0.3	4
04556 + 1653.....	HJ 3263	88.138	9.3	12.29	0.2	2
04561 + 0908.....	Bu 404	90.117	111.8	1.74	0.1	4
04562 + 0311.....	Stt 91	89.567	231.4	0.37	0.2	4
04575 + 5639.....	Kr 25	90.113	122.3	2.72	0.6	4
05003 + 3924.....	Stt 92	90.167	280.2	3.82	3.1	3
05048 + 1319.....	Hei 104	90.088	356.9	0.20	...	4
05049 + 5154.....	Hu 820	90.113	216.5	1.50	1.3	4
05049 + 3054.....	Cou 888 Aa	90.127	295.5	0.25	0.0	3
05055 + 1948.....	Hu 820	89.312	304.0	0.97	0.4	4
05070 + 3004.....	A 1028	90.084	233.4	0.37	0.7	4
05075 + 5532.....	Bu 749	90.113	239.1	1.31	1.7	4
05079 + 5459.....	StF 635	90.113	302.8	0.99	0.1	4
05092 + 1629.....	Hei 40	89.835	358.7	0.86	0.1	4
05113 + 6057.....	Mlb 160	90.104	297.1	4.06	0.4	3
05123 + 6127.....	Hu 1098	90.145	117.9	0.92	0.4	3
05130 + 0828.....	A 2701	90.140	5.6	0.44	0.1	4
05140 + 0725.....	A 1947	89.074	166.3	4.81	4.0	4
05150 + 0108.....	OI 95	88.468	195.6	0.95	0.3	3
05157 + 0113.....	J 48	88.164	37.8	2.22	0.4	2
05162 - 0329.....	Bu 318	90.075	262.4	0.60	0.1	4
05205 + 6436.....	Es 1964	90.134	262.9	5.24	0.1	3
05208 + 5037.....	StF 673	90.146	271.7	1.36	0.9	4
05243 + 2008.....	Hu 447	90.108	211.4	4.88	3.2	4
05246 + 0910.....	A 2703	90.094	98.8	0.18	0.0	4
05270 + 2737.....	Ho 226	88.164	262.2	0.68	0.1	4
05275 + 1830.....	A 2432	89.801	295.7	1.15	1.4	4
05276 + 2444.....	A 318	90.090	2.1	3.13	3.8	4
05293 + 1822.....	Stt 108	89.566	129.4	3.27	3.0	4
05301 + 2933.....	StF 719	88.179	336.1	1.26	1.5	4
05307 + 5340.....	A 1561	90.170	354.2	0.51	0.8	2
05310 + 2635.....	Cou 574	90.170	143.4	0.30	0.0	2
05340 + 2225.....	A 2106	90.167	304.1	1.55	1.4	3
05351 + 3056.....	Bu 1267	90.075	8.1	0.41	0.1	4
05352 + 3358.....	AG 97	89.797	270.2	2.08	0.5	4
05357 + 2054.....	Cou 270	88.166	41.2	0.52	0.8	3
05379 + 0857.....	A 2708	89.162	309.4	0.54	0.8	3
05399 + 3757.....	Stt 112	90.136	52.0	0.93	0.5	4
05432 + 4322.....	A 1565	87.831	196.1	4.30	0.9	3
05435 + 1642.....	A 2436	90.103	129.0	0.22	0.2	4
05436 + 1300.....	A 117	89.162	253.7	0.78	0.3	3
05447 + 3118.....	A 1040	88.164	95.5	0.84	0.6	4
05460 + 3914.....	Es 173	90.111	52.1	8.43	2.9	3
05460 + 2119.....	StF 787	88.183	61.4	0.82	0.3	3
05492 + 2550.....	OI 165	90.075	356.6	1.71	0.4	4
05560 + 0753.....	A 1948	89.366	109.7	0.58	0.2	4
05572 + 3623.....	Hu 1234	90.123	133.3	0.56	0.2	4
05588 + 0033.....	Kui 22	88.159	30.8	18.98	5.2	2
06019 + 3014.....	Cou 910	88.663	284.6	1.20	0.3	4
06037 + 3301.....	Cou 1096	90.156	65.0	1.18	0.4	4
06067 + 0459.....	HdO 81	90.065	306.0	14.71	0.8	3
06071 + 3228.....	Cou 1235	88.166	262.8	5.36	0.3	3
06078 + 4240.....	Stt 130	90.175	199.8	0.40	1.2	4
06084 + 0135.....	A 2664	88.657	263.4	0.68	0.3	4

TABLE 1—Continued

Coordinates (J2000.0) (1)	Discoverer Designation (2)	Epoch (1900+) (3)	θ (deg) (4)	ρ (arcsec) (5)	Δm (mag) (6)	n (7)
06090+0806.....	Che 90	90.065	168.1	6.32	0.6	3
06097+2914.....	A 54	90.141	341.5	0.54	0.7	4
06127+2159.....	Cou 273	89.627	144.3	1.28	1.3	4
06133+1555.....	J 18	87.508	191.9	1.71	0.7	3
06151+1351.....	Kui 25	87.835	118.9	21.12	5.7	3
06164+1216.....	Kui 26	89.198	170.9	29.73	5.5	2
06205+4708.....	StF 884	90.156	271.9	8.92	0.6	3
06221+5922.....	StF 881 Aa-B	90.160	137.7	0.76	0.8	4
06253+4931.....	HJ 2314	90.156	352.3	9.47	0.5	3
06253+0801.....	A 2812	89.627	9.0	0.48	0.3	4
06253+0801.....	A 2812 AB-C	89.627	299.4	12.26	2.2	4
06283+2441.....	Cou 914	87.951	112.3	0.18	...	4
06312+0747.....	J 263	88.513	141.4	3.27	1.4	3
06357+2816.....	A 506	90.167	38.8	0.23	0.0	3
06362+2641.....	Br1 13	88.419	37.1	5.08	1.2	4
06363+1536.....	Hei 119	90.095	150.7	1.16	0.3	4
06365+2643.....	Vdk 1	88.530	44.8	2.97	1.0	3
06365+0548.....	A 2820	88.859	52.4	4.35	4.2	3
06414+0944.....	StF 3117	88.179	83.9	0.82	0.5	4
06450+1045.....	A 2825	90.104	6.9	0.25	...	3
06504+4345.....	StF 964	90.128	185.7	1.65	0.7	4
06542+1800.....	HJ 2351	89.206	172.5	9.19	1.4	3
06556+3510.....	Hu 833	90.099	170.7	2.38	3.0	4
06563+1102.....	StF 995	88.184	292.5	21.70	0.4	2
06598+1556.....	A 2461	89.223	331.9	0.34	1.5	3
07035+3415.....	Hu 704	90.099	65.2	0.35	0.5	4
07126+0950.....	HJ 752	89.206	273.6	10.13	1.0	3
07138+2830.....	Stt 520	90.084	19.0	0.64	1.5	4
07153+0754.....	J 42	89.206	102.4	2.07	0.2	3
07215+1033.....	A 2941	88.463	80.5	3.89	2.8	4
07260+5310.....	Es 772	90.100	97.9	1.09	0.1	4
07291+0647.....	J 62	89.206	309.8	0.85	0.5	3
07292+1253.....	A 2868	88.242	13.3	0.66	0.2	3
07332+3252.....	Bu 22	88.228	150.1	6.44	3.0	3
07335+1045.....	J 281	90.188	82.7	4.87	0.5	3
07349+1435.....	Hei 131	89.206	23.5	2.62	0.4	3
07359+4302.....	Stt 174	90.167	90.6	2.13	1.4	4
07378+1522.....	Hei 50	88.463	356.7	0.74	0.0	4
07385+0030.....	Stt 176	88.242	222.5	1.49	1.7	3
07401+0514.....	StF 1126	90.128	167.1	1.10	0.3	4
07423+0455.....	Roe 70	89.214	332.4	9.30	1.1	2
07457+3433.....	Stt 181	87.960	266.9	6.68	4.0	4
07486+2308.....	WRH 15	88.873	43.6	0.24	0.3	4
07557+1240.....	J 46	89.777	290.4	2.59	1.1	3
07594+1411.....	Hei 137	90.085	73.3	0.57	0.0	3
08014+1657.....	StF 1173	88.210	51.2	10.40	1.1	3
08070+0853.....	A 2957	89.912	71.6	0.49	1.6	4
08082+2106.....	Cou 91	88.565	148.9	10.56	0.9	3
08109-0455.....	A 335	89.888	125.0	1.50	0.8	4
08143+1303.....	Kui 34	88.242	41.4	23.69	5.7	3
08148+3630.....	Hu 1123	87.554	160.3	0.40	0.4	3
08198+0357.....	Fin 346	87.976	72.1	0.27	0.1	4
08221+1551.....	Hei 142	89.206	25.7	0.48	0.3	3
08285+1212.....	HJ 93	88.890	279.2	19.14	0.3	3
08326+3227.....	Hu 717	87.900	54.3	0.46	0.3	3
08360+0331.....	HJ 2458	89.223	319.9	24.41	0.6	3
08382+2341.....	A 2127	90.141	147.2	2.84	2.9	4
08399+0413.....	A 2897	90.160	39.6	0.46	0.4	3
08432+3849.....	Bu 209	88.978	6.9	1.31	0.3	4
08514+3824.....	Es 2013	89.872	68.7	4.83	0.3	3
08557+4141.....	A 2142	89.280	205.3	0.20	...	3
		90.216	203.4	0.18	...	2
08575+2720.....	Cou 1120	87.557	312.8	0.85	0.2	3
09020+0240.....	Bu 211	88.714	273.4	1.13	1.1	4
09067+5038.....	Hu 722	90.134	233.4	0.50	0.3	4
09078-0013.....	SCJ 12	87.557	261.6	6.70	0.1	3
09081+4510.....	HJ 1164	90.199	175.2	6.37	0.4	2
09176+3641.....	Es 1734	90.141	70.8	2.64	0.7	3
09179+2834.....	StF 3121	89.242	246.4	0.26	0.0	4
		90.134	264.6	0.23	0.0	4
09252+1449.....	Hu 869	88.718	277.5	0.60	0.3	4
09273+0614.....	StF 1355	89.908	348.8	2.00	0.0	4
09305+1516.....	Hei 151	89.013	106.2	0.19	...	3
09349+0515.....	A 2757	90.208	84.4	0.34	0.8	4
09429+5035.....	Hu 629	87.906	193.8	0.34	0.6	3
09458+2500.....	Cou 776	89.243	242.6	0.90	0.2	3

TABLE 1—Continued

Coordinates (J2000.0) (1)	Discoverer Designation (2)	Epoch (1900+) (3)	θ (deg) (4)	ρ (arcsec) (5)	Δm (mag) (6)	n (7)
09477+2036.....	Cou 284	90.217	53.8	0.15	...	4
09498+2111.....	Kui 44	89.931	210.1	0.20	0.4	4
09524+2659.....	StF 1389	87.899	294.3	2.50	0.4	3
09567+2503.....	StF 1397	87.906	96.4	1.09	1.6	3
09599+1610.....	A 2482	89.686	34.6	0.78	1.0	4
10040+3239.....	Hu 631	88.998	265.2	0.95	1.2	4
10056+3105.....	StF 1406	88.998	220.8	0.87	0.8	4
10057+4103.....	A 2142	90.291	297.0	0.99	0.8	4
10110+1834.....	Cou 287	88.718	95.2	1.28	0.0	4
10151+1907.....	StF 1417	88.718	258.0	2.35	0.0	4
10152+1153.....	Hu 1254	88.718	24.7	0.64	0.2	4
10205+0626.....	StF 1426	89.722	306.5	0.98	0.4	4
10212+5625.....	Mlb 127	90.290	232.8	2.32	0.7	3
10290+3452.....	A 2152	89.314	44.0	0.43	0.3	3
10292+1009.....	Stt 220	88.742	90.2	0.78	1.4	4
10305+1444.....	J 736	88.226	207.3	2.61	0.2	3
10417+1044.....	Stt 227	90.266	0.9	0.94	0.5	4
10446+0530.....	A 2771	89.022	283.3	0.26	...	4
10453+4458.....	StF 1467	90.316	292.0	4.14	2.0	2
10472+2605.....	Cou 591	90.277	9.4	0.40	0.0	2
10493-0401.....	StF 1476	89.047	12.1	2.38	0.6	4
10496+1630.....	A 2370	89.745	332.3	2.78	0.8	4
10526+0500.....	A 2773	89.745	355.2	1.55	1.2	4
10566+1739.....	StF 1490	88.556	100.6	17.53	1.0	3
11005+0258.....	AG 173	89.745	126.3	2.21	0.6	4
11036+1851.....	J 1262	89.905	176.4	2.36	0.2	3
11040+0338.....	StF 1504	89.987	300.5	1.26	0.3	4
11050+3825.....	Ho 378	88.269	238.2	0.95	0.6	3
11053+1635.....	A 2378	90.250	138.2	0.47	0.2	3
11104+1502.....	Hei 61	88.534	92.9	0.30	0.3	4
11133+3811.....	Ku 36	89.314	136.8	8.87	0.1	3
11137+2008.....	StF 1517	90.012	325.3	0.49	0.2	4
11182+1638.....	A 2379 BC	90.248	280.6	0.37	0.2	4
11227+5544.....	Mlb 168	88.269	146.1	5.93	1.5	3
11293+3025.....	L 11	90.283	301.7	1.08	2.5	3
11297+3302.....	Cou 782	89.773	50.0	0.90	0.0	4
11362+0318.....	A 2777	90.283	85.9	3.80	4.9	3
11385+4405.....	Es 1153	87.632	259.9	5.96	2.8	3
11435+4334.....	Cou 1423	88.788	198.8	0.93	0.8	4
11468+1500.....	Bu 602	90.307	117.6	0.52	1.8	2
11504-0225.....	A 1357	89.814	225.2	1.98	3.5	4
11544+1515.....	Wor 20	89.314	305.0	1.27	0.1	3
12032+1709.....	Cou 177	88.806	298.0	1.73	0.4	4
12074+3913.....	Bar 40	89.329	139.9	1.41	3.0	3
12076+4813.....	Cou 1907	89.985	358.8	3.04	0.6	3
12140+3655.....	Es 1739	89.339	295.6	4.67	1.9	3
12141+1209.....	HJ 2603	89.026	17.3	25.27	4.7	3
12164+4444.....	A 1781	89.370	304.7	2.85	0.4	3
12167+3936.....	StF 1624	89.370	155.0	5.87	2.1	3
12175+0636.....	Bu 796	88.012	100.7	0.20	0.7	3
12197+0533.....	A 1597	89.664	292.2	1.24	3.5	3
12235+1355.....	Ho 53	87.659	304.5	2.79	2.6	3
12261-0429.....	Bu 922	90.334	119.8	0.42	0.7	4
12265-0153.....	Hld 13	90.080	138.6	1.37	0.2	4
12301-0653.....	A 2780	90.308	199.0	0.36	...	3
12306+0943.....	StF 1647	87.835	244.1	1.40	0.3	4
12334+3202.....	StF 1653	89.353	343.4	8.06	0.3	3
12360+1124.....	StF 1661	90.347	251.2	2.27	0.0	3
12372+2112.....	StF 1663	88.360	77.0	0.66	0.7	4
12387-0520.....	StF 1665	89.339	102.0	8.73	0.5	3
12409+0850.....	StF 1668	89.353	188.7	1.30	0.4	4
12418+0953.....	Ho 54 BC	85.879	142.2	2.40	0.2	4
12445+3617.....	StF 1676	89.370	350.8	4.15	0.4	3
12564-0057.....	Stt 256	88.112	98.0	0.99	0.3	4
12566+4333.....	Bu 925	89.370	214.2	6.64	4.1	3
12582+2431.....	Cou 398	90.334	53.6	0.74	0.0	4
13048+7302.....	Bu 799	90.334	263.5	1.25	1.1	4
13048+5555.....	Wor 23	90.308	158.9	1.63	0.8	3
13059+4516.....	Bu 930	90.361	127.4	2.74	3.4	2
13081+2657.....	Stt 260	88.654	195.2	0.19	...	3
13084+1529.....	StF 1722	87.659	337.0	2.80	0.8	3
13121+3655.....	StF 1730	89.112	340.2	1.90	1.3	4
13125+2050.....	Cou 55	90.334	127.3	2.28	1.1	4
13141+3156.....	A 1854	90.334	323.6	0.27	0.0	4
13175+3649.....	Hu 1146	89.339	30.3	5.03	3.8	3
13207+0257.....	StF 1734	88.441	178.6	1.17	...	3

TABLE 1—Continued

Coordinates (J2000.0) (1)	Discoverer Designation (2)	Epoch (1900+) (3)	θ (deg) (4)	ρ (arcsec) (5)	Δm (mag) (6)	n (7)
13235 + 2914.....	Ho 260	89.086	76.8	1.27	0.0	4
13291 + 1128.....	Bu 113	90.347	261.4	1.65	1.7	3
13298 + 5905.....	Es 1790	89.013	251.8	4.92	0.3	3
13328 + 1649.....	Vys 6	89.844	42.9	3.24	0.5	4
13328 + 1350.....	A 1791	89.109	357.1	3.40	2.9	4
13338 + 1339.....	Hei 164	89.348	112.4	0.52	0.0	5
13379 + 4808.....	Es 608	89.844	310.7	2.25	0.6	4
13465 + 1545.....	A 2063	90.080	141.2	0.26	0.0	4
13544 + 2955.....	Stt 272	88.441	1.4	1.50	2.9	3
13563 + 3438.....	Bu 936	90.109	97.4	4.62	3.0	4
14012 + 2522.....	A 569	89.825	139.1	0.60	0.3	4
14024 + 4620.....	Swi 1	90.334	23.1	3.67	0.0	4
14040 + 4314.....	A 1615	90.361	9.5	0.61	1.7	2
14095 + 3549.....	HJ 540	89.044	211.2	9.04	0.4	3
14098 + 0822.....	A 1098	89.030	269.2	3.82	2.1	3
14101 + 2636.....	StF 1808	88.441	80.3	2.60	0.5	3
14110 + 6024.....	Stt 280	90.366	21.8	7.10	3.2	2
14122 + 2722.....	J 1125	90.039	102.6	0.60	0.2	3
14126 + 4512.....	StF 1815	88.441	152.0	9.17	0.9	3
14142 - 0831.....	Bu 939	89.983	64.8	0.42	0.0	3
14189 + 0354.....	StF 1832	89.161	147.1	0.40	0.4	4
14213 + 3050.....	Cou 482	90.366	119.8	0.60	0.0	2
14236 + 2009.....	Cou 184	90.109	110.8	0.96	0.0	4
14380 + 5135.....	StF 1863	90.347	69.0	0.67	0.2	3
14401 + 0504.....	A 1107	88.469	91.2	0.45	1.3	3
14413 + 5239.....	A 1623	90.366	237.9	2.02	2.2	2
14453 + 2009.....	Hu 576	89.462	189.1	4.62	3.9	3
14497 + 0759.....	A 1110	88.469	248.9	0.63	0.7	3
14554 + 0647.....	HJ 1259	88.974	80.4	33.58	4.5	2
14590 + 1732.....	A 2072	88.960	254.8	0.62	0.2	4
15018 - 0008.....	Bu 348	90.361	109.4	0.52	1.6	2
15055 - 0701.....	Bu 119	90.361	281.4	2.16	0.5	2
15056 + 1138.....	StF 1138	88.452	354.4	1.00	0.1	4
15087 - 0059.....	StF 3090	89.462	285.6	0.81	0.2	3
15089 - 0635.....	A 81	89.462	43.4	0.64	0.2	3
15126 + 1523.....	StF 1917	88.450	233.5	2.44	0.2	3
15166 + 3339.....	StF 1929	88.449	8.6	6.62	1.6	2
15175 + 3241.....	Cou 793	90.361	63.2	1.43	0.0	2
15186 + 2356.....	Cou 307	90.361	16.8	0.26	...	2
15200 + 2338.....	Cou 103	87.818	282.2	0.50	0.0	3
15210 + 2104.....	Hu 146	87.818	126.8	0.59	0.3	3
15264 + 4400.....	Stt 296	89.116	280.1	1.93	1.4	3
15277 + 0606.....	StF 1944	87.990	307.0	0.78	0.6	4
15460 + 0001.....	A 2231	89.767	25.2	2.19	2.9	3
15509 + 1911.....	A 2078	87.742	162.9	1.01	0.7	4
15540 + 1936.....	Cou 67	89.462	212.8	1.69	0.0	3
15568 + 1229.....	StF 1988	89.928	254.1	1.98	0.4	4
15580 - 0311.....	A 22	89.462	220.9	5.28	3.0	3
16019 + 2458.....	Cou 411	89.462	282.8	1.47	0.6	3
16071 + 1654.....	Bu 812	89.462	102.4	0.76	0.1	3
16115 + 1507.....	A 1799	88.960	123.2	0.70	0.0	4
16168 + 0118.....	A 2180 BC	89.903	312.2	1.24	1.0	2
16197 + 1054.....	Ku 52	88.168	49.0	9.35	1.9	3
16228 - 0722.....	A 24	89.903	337.6	1.32	1.7	2
16235 + 0213.....	StF 2038	89.852	214.4	17.37	1.3	2
16276 - 0334.....	Vys 7	88.997	81.0	3.42	1.6	2
16280 + 2632.....	Bu 813	89.221	176.2	1.14	0.2	4
16309 + 0159.....	StF 2055	88.960	20.6	1.45	1.2	4
16448 + 3544.....	StF 2097	87.873	81.1	2.03	0.0	3
16567 + 1408.....	Stt 318	88.195	246.2	2.77	2.3	3
16576 + 4935.....	Cou 1772	88.475	78.8	0.25	...	2
17179 + 4918.....	StF 2153	88.816	252.4	1.58	0.5	3
17222 + 2605.....	Ho 414	87.907	101.2	0.73	0.3	3
17249 + 4701.....	A 2089	88.997	336.2	0.60	0.4	2
17294 + 3245.....	StF 2174	88.815	332.2	5.40	0.4	3
17294 + 3243.....	StF 2175	88.815	8.6	13.33	1.3	3
17403 + 6341.....	StF 2218	88.246	318.9	1.58	0.8	3
17412 + 4139.....	StF 2203	88.246	298.6	0.68	0.0	3
17490 + 2511.....	Cou 501	89.580	318.2	1.94	0.2	2
17519 + 0724.....	A 1164	87.782	42.9	0.38	0.8	4
17520 + 1520.....	Stt 338	88.686	171.6	0.87	0.1	4
17529 + 2941.....	L 16	88.106	274.2	0.16	0.0	4
17556 + 2508.....	AC 8	89.580	98.9	0.39	0.6	2
17563 + 0259.....	Cou 503	89.168	337.8	0.17	...	2
18018 + 0118.....	Bu 1125	89.646	111.2	0.63	2.9	2
18039 + 3200.....	Cou 1004	88.266	108.2	1.32	0.2	3

TABLE 1—Continued

Coordinates (J2000.0) (1)	Discoverer Designation (2)	Epoch (1900+) (3)	θ (deg) (4)	ρ (arcsec) (5)	Δm (mag) (6)	n (7)
18049+4808.....	Stt 343	88.676	81.9	3.05	2.7	4
18096+0609.....	StF 2283	88.667	64.1	0.62	0.4	4
18096+0400.....	StF 2281	88.667	314.4	0.40	0.8	4
18121+2739.....	StF 2292	89.608	272.8	1.04	0.1	3
18207+2530.....	BrT 3330	89.580	288.5	3.74	...	2
18233+2731.....	Ho 83	88.437	109.3	0.74	0.4	5
18248+0714.....	Stt 347	88.667	344.6	3.14	3.1	4
18264-0254.....	A 85	88.629	191.7	4.40	3.8	4
18291-0338.....	Fox 230	89.664	98.0	5.26	1.4	2
18338+1744.....	StF 2339 AB-CD	88.681	275.9	1.88	0.8	4
18349+2701.....	Es 477	89.608	229.6	9.82	1.4	3
18396+4056.....	Cou 1607	87.662	116.5	0.14	...	4
18410+0302.....	Bu 1328	89.608	284.5	2.03	1.1	3
18432-0650.....	A 89	88.334	141.6	5.19	3.3	3
18440+0321.....	A 2388	88.728	114.2	0.19	0.4	4
18475+1537.....	Hu 584	88.432	13.2	0.38	0.0	4
18490+0018.....	A 2263	89.608	100.2	1.53	0.5	3
18498+2124.....	Hu 327	88.158	69.4	0.31	0.0	4
18508+0842.....	Hu 256	89.608	42.4	4.33	3.0	3
18520+1047.....	StF 2408	88.696	92.0	2.30	0.6	4
18554+2324.....	Cou 511 Aa	88.728	195.8	0.61	1.0	4
18588+0207.....	Mil 6	88.720	96.0	0.66	0.4	4
18594+2936.....	StF 2340	88.728	6.3	1.56	0.1	4
19039+3409.....	Bu 1285	89.580	292.0	11.73	5.0	2
19057+2717.....	Ho 95	88.686	172.8	0.18	...	4
19071+2235.....	StF 2457	88.735	201.1	10.20	2.2	3
19074+0811.....	A 361	88.728	273.9	0.17	...	4
19104+2030.....	A 150	88.999	116.7	0.38	0.0	3
19117+2712.....	J 1206	88.706	327.2	3.09	0.7	4
19126+1651.....	Bu 139	88.227	136.8	0.64	0.9	4
19156+2925.....	AG 377	88.699	129.1	9.76	1.1	3
19162+2817.....	StF 2491	89.421	230.6	1.32	1.1	4
19167+2417.....	A 156	88.692	60.9	0.25	0.3	4
19178+0317.....	A 2268	88.227	211.4	0.50	0.7	4
19186+2157.....	StF 2499	89.774	324.4	2.59	0.2	3
19189+4952.....	Es 1095	88.011	134.5	6.84	3.7	3
19192+1540.....	A 1646	89.774	205.6	4.34	0.6	3
19232+2842.....	Mlb 470	89.307	206.3	8.80	4.5	3
19248+2246.....	StF 2517	88.673	138.0	15.74	1.4	3
19266+2530.....	StF 2524	88.724	86.0	5.57	0.4	3
19291+5912.....	Mlb 79	88.352	318.7	4.47	0.6	3
19296+1800.....	AG 231	89.774	240.8	4.30	0.2	3
19313+4729.....	A 713	88.700	274.4	0.32	0.4	4
19330+0546.....	A 367	89.775	310.2	0.87	0.9	3
19346+1808.....	Stt 375	88.781	178.4	0.56	0.9	4
19346+1022.....	A 1186	89.338	95.0	0.31	0.6	5
19355+1652.....	J 2985	88.039	43.4	6.65	0.2	3
19363+3540.....	Stt 377	89.492	35.4	0.87	0.2	4
19419+2723.....	Stt 382	88.686	329.2	0.32	0.4	4
19431+0252.....	J 1289	88.699	196.8	1.34	0.4	4
19432+2701.....	Bu 1132	88.742	215.0	0.50	0.5	4
19458+4145.....	A 601	89.787	158.0	1.31	1.0	3
19458+4033.....	Stt 385	89.818	52.5	1.22	1.5	4
19487+1504.....	A 1658	88.457	197.0	0.17	0.0	4
19501+2348.....	Cou 121	86.348	266.1	0.41	0.9	3
19516+2009.....	Hu 350	89.521	47.1	3.38	0.2	4
19525+2227.....	Ho 580	88.460	276.4	0.75	0.4	4
19575+1408.....	A 1662	89.288	199.6	0.31	0.0	4
19595+2443.....	Bu 469	88.391	187.0	14.59	1.8	3
20011+4816.....	StF 2619	89.800	239.6	4.22	0.0	4
20012+0120.....	A 2275	88.728	119.0	0.38	0.6	4
20029+1056.....	AG 397	89.454	113.2	29.22	0.7	3
20051-0418.....	Bu 56	89.506	183.3	1.40	0.9	4
20056+6342.....	StF 2642	89.810	184.9	1.90	0.0	4
20067+1256.....	Bu 428	89.820	356.6	0.80	1.3	2
20071+0759.....	A 609	88.696	305.2	0.41	0.4	4
20105+2503.....	Cou 122	87.557	350.4	0.57	2.4	4
20107+3703.....	Stt 399	89.507	279.1	4.60	2.4	4
20110+2834.....	Cou 1323	88.713	155.9	0.72	0.0	3
20119+2622.....	Bu 982	88.702	63.1	1.20	1.2	4
20157+4339.....	A 2095	89.820	14.5	0.18	0.2	2
20164+2309.....	Cou 218	89.756	218.8	0.34	0.0	4
20168+3942.....	StF 2663	89.454	322.1	5.26	0.4	3
20182+1511.....	A 1670	89.820	215.1	0.28	0.6	2
20191+2915.....	Cou 1477	89.798	101.6	0.50	0.1	4
20208-0745.....	SCJ 25	88.258	218.2	2.72	0.9	4

TABLE 1—Continued

Coordinates (J2000.0) (1)	Discoverer Designation (2)	Epoch (1900+) (3)	θ (deg) (4)	ρ (arcsec) (5)	Δm (mag) (6)	n (7)
20227+2837.....	Cou 1169	89.818	56.0	0.23	0.6	3
20244+2417.....	Cou 125	88.457	114.6	0.34	1.2	4
20244+1301.....	Hu 1198	88.801	31.5	0.54	0.8	3
20257+3745.....	Fox 36	89.818	325.5	2.66	0.4	2
20268+2804.....	A 393	89.748	219.8	0.42	0.3	4
20291+2956.....	AG 406	88.124	333.0	8.26	0.5	3
20302+2651.....	Wor 9	89.820	308.6	0.82	0.2	2
20304+3833.....	A 1430	89.816	129.9	3.44	3.5	2
20310+3656.....	AC 18	89.748	155.4	2.07	3.4	4
20311+1648.....	Roe 14	88.264	264.2	7.22	0.4	4
20311+1648.....	J 563 BC	88.723	213.4	4.78	0.4	2
20335+0527.....	StF 2696	89.512	298.6	0.58	0.2	4
20348+1857.....	J 790	88.406	88.8	2.45	0.6	3
20350+2754.....	Fox 95	89.471	196.9	4.06	0.4	3
20406+2948.....	Ho 137	88.819	343.4	0.82	3.0	3
20434+1604.....	HJ 1564	88.275	41.0	11.90	0.5	2
20478+0600.....	Bu 65	88.696	195.8	1.48	3.0	4
20521+1014.....	A 1212	88.763	14.6	0.50	0.3	4
20521+0205.....	A 2286 AB-C	89.820	44.4	1.03	0.7	2
20524+2008.....	Ho 144	88.686	347.4	0.34	0.2	4
20526+3655.....	A 1435	89.760	2.4	0.36	0.1	4
20558+2131.....	Cou 727	88.705	351.4	1.12	0.2	4
20560+3546.....	Cou 2134	89.151	268.9	0.49	1.2	3
20562+3335.....	Es 2312	89.807	14.0	2.68	2.1	3
20565+2712.....	Cou 832	88.809	264.3	1.25	0.9	3
20587+1823.....	Hu 363	89.805	103.5	0.77	0.0	3
20590+3218.....	Cou 1636	88.816	9.7	0.76	0.1	4
20593+1534.....	Stt 424	88.465	308.2	0.49	0.7	4
21009+0257.....	HJ 3006	89.770	292.0	1.89	0.2	2
21037+3104.....	Stt 427	88.693	150.5	4.21	3.7	3
21045+0746.....	Bu 269	88.706	243.3	1.19	2.0	4
21050+1243.....	A 1690 BC	89.798	113.0	0.49	0.6	4
21065+2655.....	Cou 527 Aa	88.832	332.2	0.32	0.1	4
21067+3455.....	Hu 691	88.825	312.5	0.30	0.4	4
21103+1008.....	Knt 5	88.749	270.0	1.44	3.3	4
21107+1334.....	Hei 186	88.838	227.1	0.36	0.6	4
21115+4115.....	Stt 431	88.884	124.9	2.65	0.1	4
21141+5818.....	StF 2783	88.884	5.2	0.70	0.0	4
21171+3546.....	Bu 162	88.897	252.5	1.23	0.1	4
21173+5837.....	Bu 1140	89.851	274.0	3.98	...	2
21177+3345.....	Ho 153	88.897	121.6	0.97	0.9	4
21197+3315.....	Ho 155	88.750	35.0	2.00	1.2	4
21213+6042.....	StF 2795	89.564	300.5	1.72	0.2	4
21214+6016.....	Mlr 15	89.833	31.0	0.34	0.0	4
21218+4309.....	Stt 438	88.729	358.0	2.15	2.0	4
21251+0923.....	Bu 164	88.845	205.7	0.16	...	4
21252+1828.....	Cou 430	87.786	236.1	0.54	1.8	4
21264+4911.....	Es 822	88.711	27.5	1.41	0.1	3
21271+2405.....	Cou 133	88.837	93.4	3.47	2.0	3
21287+5710.....	Bu 1142	89.833	4.4	0.38	0.1	4
21287+4952.....	StF 2800	88.699	255.0	9.20	0.6	3
21293+4512.....	Es 100	89.798	157.4	4.25	0.7	4
21305+4620.....	A 768	89.798	333.0	0.58	0.1	4
21308+4752.....	A 769	88.748	291.7	0.71	0.0	5
21310+2128.....	Cou 232	88.768	32.4	0.64	0.0	4
21317+4508.....	AG 272	88.887	183.8	4.15	0.1	3
21345+4725.....	Es 1172	88.866	105.3	6.53	0.8	4
21349+0308.....	A 2291	88.682	94.6	1.06	0.2	4
21350+4723.....	Es 1173	89.331	98.9	3.68	1.7	4
21362+3003.....	Bu 167	89.348	88.0	1.78	3.1	4
21383+2336.....	Hu 372	88.786	232.0	0.22	0.0	4
21385+4317.....	Da 15	88.811	74.7	1.53	2.2	3
21391+3356.....	Cou 1185	89.833	56.1	1.40	0.2	4
21421+5322.....	A 1894	88.856	143.2	1.98	1.1	3
21434+4417.....	HJ 1685	88.882	237.4	18.54	0.2	2
21454+4356.....	Ho 168	88.888	234.1	0.80	0.1	4
21455+6745.....	Hu 970	88.829	275.8	0.35	0.2	3
21461+2111.....	AG 277	88.249	59.6	2.57	0.0	4
21484+5721.....	Mlb 143	88.846	355.6	1.78	0.2	3
21489+0523.....	Hu 281	88.686	145.5	1.53	0.6	4
21493+3451.....	Cou 1483	89.751	125.0	0.60	0.9	3
21496+3606.....	Ho 169	89.205	138.0	3.55	3.0	3
21498+3455.....	Cou 1484	89.218	0.6	0.33	1.1	3
21516+6545.....	StF 2843	88.801	146.6	1.50	0.2	3
21543+1333.....	Bu 1213 BC	88.841	308.7	0.80	0.8	4
21545+4403.....	A 620	88.888	279.0	0.33	0.0	4

TABLE 1—Continued

Coordinates (J2000.0) (1)	Discoverer Designation (2)	Epoch (1900+) (3)	θ (deg) (4)	ρ (arcsec) (5)	Δm (mag) (6)	n (7)
21561+6539.....	Hu 974	88.845	103.1	4.45	2.5	3
21565+1940.....	Hu 382	88.841	210.5	0.31	0.4	4
21572+1047.....	A 622	89.816	298.8	0.10	...	2
22009+6250.....	Hu 976	88.868	54.4	1.61	0.0	3
22086+5917.....	StF 2872 BC	88.778	303.1	0.78	0.1	4
22100+0757.....	StF 2867	88.724	209.1	10.51	1.2	3
22101+3221.....	Ho 641	89.851	161.6	10.42	5.2	2
22103+1345.....	Stt 1345	88.284	358.3	3.78	3.4	4
22107+5327.....	Roe 92	88.890	104.3	4.68	0.9	3
22107+0755.....	Wor 10	84.713	91.2	0.59	1.0	1
22109+4211.....	A 2494	88.892	356.6	0.26	0.0	4
22110+6324.....	StF 2879	88.807	231.9	0.79	0.1	3
22113+4010.....	Stt 464	88.461	150.9	0.26	0.0	4
22117+5743.....	A 625	88.888	80.2	0.42	0.2	4
22117+3149.....	A 1228	89.851	350.0	3.76	1.7	2
22118+5944.....	StF 2880	88.888	351.1	4.19	2.4	4
22122+6344.....	StF 2884	89.582	145.2	2.20	1.3	4
		89.582	324.4	6.83	0.9	4
22146+2934.....	StF 2881	88.249	79.8	1.32	0.5	4
22171+4633.....	A 184	88.755	316.5	2.58	1.9	3
22173+5049.....	Hu 595	89.592	213.0	0.46	1.4	4
22196+2107.....	Hu 383	88.869	32.1	0.30	0.0	4
22201+4625.....	A 185	88.818	313.9	0.73	0.2	3
22234+3228.....	Wor 11	88.768	195.1	1.71	0.2	4
22269+5712.....	Bu 173	88.896	233.6	2.84	2.4	4
22272-0146.....	StF 2904	88.891	311.1	8.27	0.3	4
22306+5429.....	Es 1023	88.906	91.8	3.73	0.0	4
22328+2625.....	Ho 475	88.878	308.5	1.00	0.2	4
22342+5405.....	A 1468	88.911	255.2	0.24	0.0	5
22375+3855.....	StF 2926	88.768	335.1	21.45	0.3	3
22395+4123.....	Bu 277	89.837	214.5	0.46	0.2	3
22397+5441.....	A 1473	88.906	287.4	1.44	0.6	4
22430+1144.....	J 208	88.875	71.1	3.57	0.3	3
22449+5035.....	Es 848	88.906	62.4	2.24	0.6	4
22451-0240.....	A 2696 BC	88.836	98.6	0.47	0.6	4
22514+6142.....	StF 2950	88.906	284.6	1.46	1.2	4
22546+2020.....	Bu 847	89.372	35.9	6.73	0.6	4
22563+4247.....	A 416	88.879	337.3	0.34	0.7	3
22579+5439.....	A 1477	89.396	349.4	0.58	1.4	2
23003+1400.....	Bu 850	88.712	120.0	3.28	2.6	3
23033+1129.....	Roe 132	89.837	69.3	1.17	0.7	3
23049+1539.....	WRH 2	88.246	99.8	5.50	0.3	2
23052+6323.....	Kr 62	88.888	322.7	5.45	0.3	4
23055+4643.....	A 196	89.146	305.1	0.40	0.6	4
23072+6050.....	Bu 180	88.878	141.6	0.50	0.5	4
23078+1240.....	Bu 1025	88.236	321.2	0.76	2.2	4
23087+1533.....	Hu 995	89.370	196.6	0.94	0.5	4
23102+5727.....	Stt 490	88.810	296.9	1.36	2.6	3
23104+4901.....	StF 2987	88.810	153.3	4.10	2.7	3
23112+2759.....	Mlb 503	89.221	157.6	7.88	0.4	3
23144+0739.....	A 1900	88.836	238.8	1.05	1.1	4
23208+2158.....	Stt 494	88.893	82.2	3.32	0.2	4
23244+1429.....	Bu 719	88.787	343.5	1.38	2.7	4
23260+2742.....	Ho 489	89.521	228.1	0.52	0.2	3
23318+2148.....	Cou 243	88.898	350.4	0.60	0.7	3
23352+1133.....	HJ 3203	88.925	212.8	6.52	0.4	2
23380+1253.....	A 1241	89.515	4.1	0.61	1.1	3
23413+3234.....	Bu 858	88.906	230.0	0.82	0.6	4
23420+2018.....	Stt 503	89.579	132.5	1.21	0.3	3
23481+1009.....	StF 3040	88.756	217.4	4.39	0.0	3
23502+1940.....	Cou 344	89.364	12.0	0.21	0.0	2
23522+2835.....	Ho 204	88.921	356.5	5.97	...	3
23536+1207.....	Vys 11	88.879	164.7	5.91	1.2	3
23598+0640.....	Ald 8	88.879	15.6	4.22	3.3	3

TABLE 2
MICROMETER MEASUREMENTS AND RESIDUALS TO SYSTEMS WITH ORBITS

Coordinates (J2000.0) (1)	Discoverer Designation (2)	Epoch (1900+) (3)	θ (deg) (4)	ρ (arcsec) (5)	Δm (mag) (6)	n (7)	$O - C$ (deg) (8)	$O - C$ (arcsec) (9)	Reference (10)	Notes (11)
00014+3937.....	Hld 60	88.893	179.7	1.16	0.6	4	1.3	0.04	Heintz 1963	
00022+2705.....	Bu 733	90.006	64.8	0.32	2.9	2	-5.4	-0.11	Hall 1949	
00048+3810.....	Bu 862	88.884	12.2	0.61	0.5	4	-1.8	0.00	Couteau 1986	
00057+4549.....	Stt 547	89.942	177.4	6.05	0.0	3	-0.7	-0.00	Kiselev & Kiyaveva 1988	
00063+5826.....	StF 3062	88.316	304.0	1.39	1.0	4	-0.9	-0.07	Baize 1957	
00134+2659.....	Stt 2	88.359	185.0	0.30	1.0	4	3.8	0.02	Heintz 1979	
00162+7657.....	StF 13	88.317	57.5	0.89	0.3	4	2.8	0.02	Heintz 1959	
00167+3629.....	Stt 4	88.789	163.9	0.40	0.6	4	-3.3	-0.11	Starikova 1983	
00206+1219.....	Bu 1015	88.903	83.0	0.33	0.4	4	1.3	-0.05	Baize 1974	
00283+6344.....	Hu 1007	89.942	74.6	0.49	0.4	3	-2.1	0.01	da Silva & Balca 1968	
00318+5431.....	Stt 12	89.942	190.2	0.51	0.2	3	0.5	0.03	Heintz 1995	
00424+0410.....	Stt 18	88.317	199.6	1.75	1.3	4	-6.3	0.23	Baize 1958a	
00487+1841.....	Bu 495	88.840	15.9	0.27	...	4	0.7	-0.01	Couteau 1989	
		89.938	10.5	0.25	0.0	3	-1.2	-0.02		
00546+1911.....	Stt 20	88.897	208.3	0.47	0.7	3	1.6	0.00	Couteau 1984	
00550+2338.....	StF 73	88.897	284.8	0.74	0.2	3	1.4	0.03	Docobo & Costa 1990	
		89.955	287.2	0.72	0.2	4	0.8	-0.01		
00593-0040.....	A 1902	88.787	184.2	0.31	0.6	4	1.5	-0.01	Docobo & Costa 1989	a
00596-0111.....	A 1903	88.787	329.3	0.31	0.0	4	-3.0	-0.04	Mason & Hartkopf 1998	
01014+1155.....	Bu 867	89.911	2.6	0.46	...	2	-0.7	0.07	Baize 1993	
01112+4113.....	A 655	89.672	315.3	0.34	0.5	4	-9.6	0.03	Heintz 1986a	
01437+0934.....	Bu 509	87.529	100.0	0.34	0.0	3	13.4	0.02	Scardia 1983c	
01570+3101.....	A 819	89.942	214.2	0.27	0.7	3	1.1	-0.02	Heintz 1997	
02037+2556.....	StF 208	89.673	332.6	1.18	1.4	4	2.8	0.09	Heintz 1996c	
02159+0638.....	A 2013	89.969	109.4	0.46	0.2	3	2.5	0.02	Costa & Docobo 1983	
02407+2637.....	Stt 43	90.074	3.6	0.83	0.9	4	0.7	-0.16	Heintz 1962	
02572+0153.....	A 2413	89.100	114.6	0.34	0.1	4	-2.2	0.02	Heintz 1991	
02586+2408.....	Bu 1173	89.100	91.3	0.25	0.0	4	-0.3	0.01	Baize 1987	
02589+2137.....	Bu 525	89.100	262.8	0.48	0.2	4	1.5	-0.02	Costa 1978	
		90.110	263.7	0.53	0.0	3	1.8	0.03		
03122+3713.....	StF 360	90.074	126.8	2.66	0.4	4	1.5	0.09	Hopmann 1965	
03127+7133.....	Stt 50	89.774	164.6	1.13	0.2	4	3.7	0.13	Popovic 1972	
03140+0044.....	StF 367	89.100	140.6	1.09	0.1	4	1.6	0.04	Heintz 1963	
03175+6540.....	Stt 52	89.774	71.0	0.46	0.4	4	10.1	0.03	Heintz 1963	
03344+2428.....	StF 412	90.022	2.2	0.66	0.1	4	2.7	0.04	Scardia 1985	
03503+2535.....	Stt 65	88.767	210.7	0.41	0.4	3	0.1	0.01	Wierzbinski 1957a	b
04041+3931.....	StF 483	90.103	69.8	1.18	1.5	4	1.0	0.18	Couteau 1990	
04064+4325.....	A 1710	90.108	323.4	0.50	0.2	4	-0.8	0.05	Heintz 1982	
04076+3804.....	Stt 531	90.108	4.8	1.86	1.4	4	1.9	0.01	Heintz 1986b	a
04091+2839.....	Ho 326	89.550	274.6	0.37	0.1	4	-0.7	-0.04	Heintz 1997	
04132+2258.....	Hu 302	89.699	46.6	0.25	0.0	5	-6.8	0.08	Erceg 1984	
04159+3142.....	Stt 77	90.139	278.9	0.68	0.4	4	0.2	-0.01	Starikova 1985	a
04170+1941.....	Ho 328	87.888	10.4	0.38	0.3	4	-0.1	-0.01	Heintz 1978	
04179+5847.....	StF 511	90.108	101.2	0.44	0.3	4	2.0	-0.04	Heintz 1996b	
04182+2248.....	StF 520	90.098	65.4	0.36	0.0	4	-1.8	-0.01	Heintz 1982	
04227+1503.....	Stt 82	90.156	352.6	1.42	1.5	4	0.6	0.01	Heintz 1969	
04301+1538.....	StF 554	90.139	16.4	1.63	2.0	4	-1.7	-0.12	Baize 1980	b
04496+0212.....	A 2621	90.127	95.7	0.15	0.0	3	13.3	-0.02	Erceg 1978	
04599+5327.....	A 1303	90.135	296.6	0.20	...	4	2.0	0.08	Scardia 1983d	
05079+0830.....	Stt 98	88.164	357.8	0.69	0.8	4	-3.4	0.00	Baize 1969	
05098+2802.....	Bu 1047 BC	90.170	77.4	0.28	0.2	2	-7.0	-0.04	Heintz 1976	
05135+0158.....	Stt 517	90.186	238.3	0.61	0.4	2	-2.3	0.11	van den Bos 1960	b
05247+6323.....	StF 677	90.123	142.3	1.08	0.7	4	-2.1	0.03	Heintz 1996b	b
05308+0557.....	StF 728	90.175	46.6	1.16	1.1	4	-4.5	0.16	Siegrist 1951	
05387-0236.....	Bu 1032	90.175	131.1	0.25	1.1	4	-4.5	-0.00	Hartkopf et al. 1996	a
05413+1632.....	Bu 1007	90.141	246.2	0.32	0.8	4	4.8	-0.00	Docobo & Ling 1994b	
05482+0137.....	A 2657	90.085	175.8	0.26	...	4	-4.0	0.07	Docobo & Prieto 1993	a,b
05558+3656.....	Stt 122	87.926	258.6	0.29	0.7	4	0.9	-0.00	Ling & Prieto 1990	a
06041+2316.....	Kui 23	90.076	194.7	0.28	0.5	4	0.7	0.04	Mason & Hartkopf 1998	a
06159+0110.....	Rst 5225	88.931	259.3	0.18	0.0	4	0.3	0.04	Tokovinin 1986	
06200+2826.....	Bu 895	90.177	132.7	0.26	0.1	3	-0.3	-0.00	Zulevic 1971	
06214+0216.....	A 2667	87.946	183.0	0.30	0.6	4	-1.8	0.05	Scardia 1983e	
06256+2227.....	Stt 139	90.151	255.4	0.63	2.0	4	-1.9	0.09	Heintz 1962	
06314+0749.....	A 2817	90.110	114.0	0.20	0.0	3	-6.3	0.04	Baize 1958b	
06344+1445.....	StF 932	87.935	312.4	1.72	0.1	4	3.7	-0.02	Hopmann 1960	
06364+2717.....	Stt 149	90.206	317.5	0.68	1.4	2	4.6	0.05	Scardia 1982	
06462+5927.....	StF 948	90.109	78.2	1.78	0.4	4	4.5	0.09	Brosche 1957	
06474+1812.....	Stt 156	87.932	231.2	0.38	0.4	4	-1.3	-0.04	Baize 1992	
06478+0020.....	Stt 157	89.214	199.4	0.35	0.2	4	2.7	-0.01	Heintz 1973	
06575+0253.....	A 2681	87.967	317.6	0.29	0.2	4	13.9	0.05	Heintz 1975	a
07036+3941.....	A 1959	90.152	342.2	0.28	...	2	3.7	0.05	Couteau 1987	
07128+2713.....	StF 1037	88.228	318.5	1.21	0.0	3	0.6	0.00	Scardia 1983a	
07303+4959.....	StF 1093	90.076	190.9	0.92	0.1	4	-1.5	0.14	Scardia 1984a	
07346+3153.....	StF 1110	88.227	80.7	2.89	0.8	5	0.6	0.02	Heintz 1988a	a
		89.947	77.7	3.11	0.9	6	0.3	0.10		a

TABLE 2—Continued

Coordinates (J2000.0) (1)	Discoverer Designation (2)	Epoch (1900+) (3)	θ (deg) (4)	ρ (arcsec) (5)	Δm (mag) (6)	n (7)	$O-C$ (deg) (8)	$O-C$ (arcsec) (9)	Reference (10)	Notes (11)
07351+3058.....	Stt 175	89.214	322.9	0.26	0.0	4	-4.3	0.05	Hartkopf et al. 1989	
		90.101	323.1	0.24	0.0	6	-3.8	0.03		
07417+0942.....	StF 1130	88.970	347.4	0.39	0.3	4	-3.3	0.08	Baize 1984	b
		90.109	349.2	0.36	0.4	4	-6.9	0.06		
07461+2107.....	Ho 247	87.960	237.1	0.38	0.4	4	-1.7	-0.02	Heintz 1984a	
		89.909	239.5	0.38	0.2	5	-1.7	-0.02		
08041+3302.....	Stt 187	88.970	353.0	0.34	0.2	4	0.3	-0.02	Mason & Hartkopf 1998	
08044+1217.....	Bu 581	90.198	288.5	0.51	0.1	3	-1.1	0.03	Heintz 1974	
08122+1739.....	StF 1196	88.223	197.6	0.58	0.5	4	-5.8	-0.03	Gasteyer 1954	b
		89.214	187.0	0.64	0.5	4	-4.3	0.04		
		90.101	175.2	0.64	0.5	6	-5.1	0.04		
08316+3458.....	Hu 716	87.900	309.6	0.36	1.5	3	-12.4	0.04	Heintz 1988b	a
		90.216	300.6	0.50	1.4	2	-9.7	0.09		a
08468+0625.....	Sp 1	87.900	242.5	0.20	1.1	3	-3.8	-0.04	Hartkopf et al. 1996	
08468+0625.....	StF 1273 AB-C	87.900	287.3	2.90	3.3	3	-4.6	0.18	Heintz 1996a	
08487+0057.....	A 2552	89.204	113.6	0.14	...	3	2.4	-0.00	Scardia 1983e	
08531+5457.....	A 1584	87.273	354.6	0.15	...	1	-3.8	0.02	Heintz 1991	
		88.166	19.8	0.20	...	1	1.9	0.03		
		89.242	35.7	0.22	0.4	4	3.4	0.00		
		90.132	41.9	0.25	0.1	4	1.6	-0.00		
08549+2612.....	A 2131	90.216	213.0	0.42	1.1	2	-0.4	0.04	Baize 1980	
08559+7048.....	StF 1280	88.223	152.4	1.02	0.2	3	-0.8	-0.01	Heintz 1997	
		89.242	159.8	1.00	0.3	4	0.8	-0.00		
		90.132	164.9	0.98	0.2	4	0.6	0.01		
09006+4147.....	Kui 37	90.208	234.4	0.56	1.9	4	-0.4	0.03	Hartkopf et al. 1996	a
09123+1500.....	Fin 347 Aa	87.252	300.7	0.15	...	2	-3.8	0.01	Mason et al. 1996	
09210+3811.....	StF 1338	89.280	271.6	1.01	0.3	3	1.8	-0.04	Arend 1953	
09245+1808.....	A 2477	87.990	338.4	0.38	0.5	4	0.7	-0.02	Mason & Hartkopf 1998	
09260+2839.....	A 222	90.243	32.0	0.29	0.1	3	0.2	0.03	Heintz 1997	
09285+0903.....	StF 1356	89.266	51.7	0.50	0.9	4	1.6	0.04	van Dessel 1976	
09521+5404.....	Stt 208	88.222	169.6	0.20	...	2	-1.3	0.02	Heintz 1996b	
		89.275	183.0	0.22	...	4	1.6	0.04		
		90.217	190.6	0.22	0.3	4	-0.2	0.04		
10121+2118.....	A 2146	88.253	57.6	0.21	0.0	3	-10.6	0.02	Heintz 1976	
10163+1744.....	Stt 215	89.722	182.3	1.42	0.2	4	-0.3	-0.01	Zaera 1984	
10192+2034.....	StF 1423	89.291	0.6	0.86	0.5	4	-1.2	-0.11	Heintz 1997	
10227+1521.....	Stt 216	90.328	252.1	1.75	2.6	3	-6.4	0.08	Heintz 1978	
10250+2437.....	StF 1429	89.722	176.5	0.62	0.2	4	-0.1	-0.01	Zulevic 1981	
10269+1713.....	Stt 217	89.714	144.2	0.61	0.4	4	-0.4	0.07	Heintz 1975	
10397+0851.....	Stt 224	88.742	168.6	0.56	1.1	4	-0.1	-0.01	Heintz 1984b	
10557+0044.....	Bu 1076	89.275	62.4	1.20	2.8	3	2.9	0.11	Morel 1970	
11047-0413.....	A 676 BC	88.279	80.9	0.30	...	3	15.6	0.02	Heintz 1986a	
		90.248	91.6	0.34	...	4	11.0	0.07		
11136+5525.....	A 1353	86.854	222.2	0.41	0.8	4	-1.8	-0.02	Heintz 1997	a
11182+3132.....	StF 1523	88.262	74.3	1.64	0.5	3	-0.2	-0.01	Mason et al. 1995	a
		89.291	65.6	1.49	0.4	4	-0.5	0.08		a
		90.268	56.8	1.19	0.4	5	1.7	-0.00		a
11190+1416.....	StF 1527	90.018	43.4	0.98	0.7	4	-1.2	0.07	Popovic & Pavlovic 1995	
11239+1032.....	StF 1536	89.291	125.6	1.49	2.4	4	-0.6	0.06	Heintz 1986a	
11308+4117.....	Stt 234	88.787	141.5	0.38	0.4	4	0.1	-0.02	Couteau 1989	
		90.262	145.2	0.42	0.3	4	1.0	-0.00		
11323+6105.....	Stt 235	88.797	280.0	0.58	1.4	4	1.1	-0.01	Heintz 1990	
11374+4728.....	Ku 39	87.815	94.9	1.30	0.2	4	2.3	-0.13	Zulevic 1986	
11486+1417.....	Bu 603	88.342	351.4	1.00	2.5	3	3.3	-0.12	Heintz 1991	
12108+3953.....	StF 1606	88.360	230.8	0.31	0.2	4	-1.8	0.02	Mason & Hartkopf 1998	
		89.353	226.0	0.30	0.4	4	-1.8	0.01		
12160+4807.....	Hu 736	90.307	213.8	0.26	...	2	0.2	0.02	Baize 1994	a
12160+0538.....	StF 1621	88.342	15.5	0.80	0.4	3	-8.4	-0.00	Heintz 1982	
		89.353	15.4	0.80	0.6	4	-11.0	-0.04		
12417-0127.....	StF 1670	88.360	288.4	3.02	0.0	4	0.2	0.02	Heintz 1990	
		90.334	286.5	2.82	0.1	4	1.0	0.03		
12422+2622.....	A 1851	90.277	278.1	0.48	0.4	2	3.7	0.00	Heintz 1986a	a
12507+2032.....	Hu 640	90.334	345.4	0.55	0.2	4	-1.5	0.03	Baize 1984	
12533+2115.....	StF 1687	87.844	174.2	1.12	2.1	4	2.6	0.09	Heintz 1997	
13100+1732.....	StF 1728	88.112	191.7	0.29	...	4	-0.6	0.05	Hartkopf et al. 1989	
13198+4747.....	Hu 644 Aa-B	89.370	264.2	1.06	0.9	3	-0.3	-0.04	Mason & Hartkopf 1998	
13258+4430.....	A 1609	88.408	309.9	0.28	...	2	-3.5	-0.00	Heintz 1991	
		89.343	319.5	0.28	0.1	4	-0.9	-0.02		
		90.334	328.8	0.30	0.4	4	2.0	-0.02		
13343-0019.....	StF 1757	88.441	118.3	2.21	0.9	3	0.4	-0.01	Heintz 1988b	
13396+1045.....	Bu 612	88.431	224.3	0.28	0.0	4	-0.4	-0.02	Mason & Hartkopf 1998	
13461+0507.....	StF 1781	88.431	156.9	0.48	0.4	4	6.4	-0.00	Heintz 1986a	b
		89.357	156.5	0.55	0.6	3	3.2	0.04		
13491+2659.....	StF 1785	90.334	165.6	3.47	0.4	4	-0.6	0.03	Heintz 1988b	
14131+5520.....	StF 1820	88.441	113.7	2.62	0.4	3	-1.3	0.35	Hopmann 1964	
14135+1234.....	Bu 224	89.421	126.3	0.29	0.4	4	0.0	-0.00	Ling 1985	

TABLE 2—Continued

Coordinates (J2000.0) (1)	Discoverer Designation (2)	Epoch (1900+) (3)	θ (deg) (4)	ρ (arcsec) (5)	Δm (mag) (6)	n (7)	$O-C$ (deg) (8)	$O-C$ (arcsec) (9)	Reference (10)	Notes (11)
14153+0308.....	StF 1819	88.901	224.3	0.84	0.3	4	0.6	-0.04	Houser 1987	
14323+2641.....	A 570	88.476	254.6	0.18		2	2.9	0.00	Heintz 1991	
		89.462	240.8	0.21	0.3	3	2.1	0.02		
14369+4813.....	A 347	90.347	266.9	0.62	0.1	3	0.2	0.05	Baize 1987	
14426+1929.....	Hu 575	89.462	281.6	0.31	0.1	3	-0.5	0.01	Muller 1952	
		90.361	270.4	0.26	0.0	2	2.4	-0.04		
14463+0939.....	StF 1879	88.469	89.0	1.64	0.6	3	1.2	0.12	Wierzbinski 1957b	b
14515+4456.....	Stt 287	90.366	171.2	0.96	0.2	2	1.7	0.00	Heintz 1997	
14534+1542.....	Stt 288	90.366	170.0	1.30	0.6	2	0.9	0.03	Heintz 1988b	
15038+4739.....	StF 1909	89.880	49.9	1.66	...	4	2.2	0.01	Heintz 1997	
15160-0454.....	StF 3091	90.361	230.8	0.56	0.4	2	5.4	0.06	Laques & Morel 1971	
15183+2650.....	StF 1932 Aa-B	88.960	256.0	1.52	0.0	4	1.2	0.01	Heintz 1965	
15232+3017.....	StF 1937	88.469	20.3	0.99	0.5	3	-0.9	-0.02	Mason & Hartkopf 1998	
		89.462	24.7	1.06	0.5	3	0.3	0.03		
		90.361	27.6	1.10	0.4	2	0.4	0.05		
15360+3948.....	Stt 298	88.469	289.6	0.31	0.0	3	-1.4	0.02	Couteau 1989	
		89.462	310.6	0.31	0.0	3	1.3	0.02		
		90.361	324.2	0.32	...	2	-0.2	0.01		
15396+7959.....	StF 1989	88.817	27.1	0.64	0.6	3	1.6	0.03	Giannuzzi 1956	a,b
15427+2618.....	StF 1967	88.960	118.8	0.68	2.0	4	0.2	0.11	Hartkopf et al. 1989	
16044-1122.....	StF 1998	88.469	40.6	0.82	0.3	3	-2.4	0.10	Harrington 1987	b
16169+0113.....	A 2181	89.734	64.4	0.44	0.0	3	5.1	0.03	Heintz 1996b	a
16289+1825.....	StF 2052	88.469	129.7	1.73	0.0	3	-0.2	0.03	Scardia 1984b	
16318-0701.....	StF 3105	88.029	199.5	0.34	0.1	4	1.9	-0.03	Heintz 1996b	
16413+3136.....	StF 2084	88.960	87.1	1.57	2.4	4	-1.0	0.00	Heintz 1994	
16413+3006.....	A 349	89.130	159.1	0.49	0.4	3	0.2	-0.01	Heintz 1996b	a
16514+0113.....	Stt 315	89.810	334.6	0.29	1.8	3	3.1	-0.04	Docobo & Ling 1991	
17053+5428.....	StF 2130	88.816	33.6	2.17	0.0	3	1.1	0.07	Heintz 1981	
17121+4540.....	Kui 79	88.475	206.2	0.93	0.4	2	-0.8	0.05	Hartkopf et al. 1996	
		90.309	170.1	0.36	0.3	1	3.1	-0.08		
17166-0027.....	A 2984	89.967	2.0	1.00	2.6	2	0.4	-0.05	Popovic & Catovic 1993	
17304-0104.....	StF 2173	89.017	336.0	1.13	0.2	4	1.6	0.02	Heintz 1984a	
17420+1557.....	Bu 1251	89.168	133.8	1.24	2.9	2	-0.9	0.15	Baize 1991	
17465+2743.....	AC 7 BC	88.567	64.6	1.77	0.4	4	2.6	0.17	Couteau 1960	b
		89.612	66.0	1.86	0.4	4	1.4	0.29		
18055+0230.....	StF 2272	88.626	252.7	1.60	2.0	8	1.6	-0.00	Heintz 1988c	
		89.612	238.4	1.57	1.9	4	2.3	0.05		
18146+0011.....	StF 2294	88.667	95.6	1.23	0.0	4	1.7	0.10	Luyten 1934	
18197+1016.....	Hu 197	88.706	111.6	0.34	0.7	4	1.2	0.00	Heintz 1995	
18250-0135.....	AC 11	89.651	356.5	0.93	0.4	3	0.9	0.06	Heintz 1995	
18355+2336.....	Stt 359	88.720	9.4	0.67	0.0	4	1.4	0.01	Symms 1964	a
18359+1659.....	Stt 358	88.720	160.6	1.62	0.2	4	0.7	-0.04	Heintz 1995	
18360+1144.....	Stt 357	88.720	96.8	0.34	0.1	4	2.1	-0.02	Valbousquet 1981	
18413+3018.....	StF 2367	88.696	86.6	0.18	...	4	1.3	0.00	Batten et al. 1982	a
18437+3141.....	A 253	88.696	119.5	0.92	0.7	4	-3.4	0.09	Baize 1987	
18570+3254.....	Bu 648	88.676	24.3	1.06	2.2	4	0.4	0.03	Heintz 1994	
		89.687	23.0	1.06	2.1	5	2.9	0.08		
19055+3352.....	Hu 940	88.742	203.3	0.50	0.3	4	0.7	-0.05	Docobo & Ling 1997	
19266+2719.....	StF 2525	88.706	292.2	1.92	0.2	4	0.4	0.02	Heintz 1984b	
19282-1209.....	Scj 22	88.682	197.2	0.40	0.4	4	-1.5	-0.05	Heintz 1988b	
		89.680	204.6	0.47	0.4	4	-2.3	0.01		
19450+4508.....	StF 2579	89.754	229.7	2.48	3.0	5	-0.1	-0.03	Scardia 1983b	
19456+3337.....	StF 2576	88.706	171.4	2.28	0.1	4	1.7	-0.04	Rabe 1948	
19487+3519.....	Stt 387	88.720	161.7	0.60	0.5	4	3.0	-0.07	Heintz 1996c	
19490+1909.....	AGC 11	88.461	171.5	0.25	0.8	4	1.1	0.02	Heintz 1984b	
19573+0513.....	A 604	89.529	64.0	0.17	...	4	-0.3	0.00	Heintz 1991	
20102+4357.....	Stt 400	88.676	11.2	0.32	0.8	4	-0.9	0.05	Heintz 1997	
		89.818	8.6	0.29	0.8	2	1.1	-0.01		
20329+1357.....	L 35 CD	88.716	229.2	0.38	0.3	6	0.2	0.03	Heintz 1995	a
20375+1436.....	Bu 151	88.676	157.2	0.27	0.8	4	1.1	0.02	Hartkopf et al. 1989	
		89.770	175.5	0.32	0.9	6	3.1	0.02		
20396+0458.....	Kui 99	88.676	122.3	0.89	1.2	4	-3.2	0.09	Heintz 1984b	
		89.770	124.3	1.02	1.4	6	-2.0	0.18		
20474+3629.....	Stt 413 Aa-B	88.841	13.9	0.90	1.2	6	1.0	-0.01	Baize 1983	
20494+1124.....	J 194	88.696	189.7	0.75	0.1	4	-3.8	-0.01	Baize 1986	b
20591+0418.....	StF 2737	88.884	287.6	0.96	0.3	4	2.2	-0.05	van den Bos 1933	
21125+2821.....	Ho 152	88.792	100.8	0.18	...	4	-8.0	-0.02	Baize 1981	b
21137+6424.....	H 48	88.884	263.0	0.30	0.0	4	3.7	-0.05	Baize 1984	b
21148+3803.....	AGC 13	89.780	20.3	0.56	2.5	6	-1.6	-0.01	Mason & Hartkopf 1998	a
21289+1105.....	StF 2799	88.888	268.2	1.71	0.1	4	2.7	0.02	Popovic 1987	
21395+3009.....	A 772	88.486	263.1	0.15	...	4	13.8	-0.00	Baize 1981	
21395-0003.....	Bu 1212	88.456	259.4	0.42	0.3	4	3.5	-0.03	Heintz 1994	
21439+2751.....	Ho 166	88.686	74.8	0.31	0.0	4	-1.3	-0.04	Couteau 1958	
21441+2845.....	StF 2822	88.686	302.4	1.96	1.6	4	1.3	-0.05	Heintz 1995	a
		89.840	302.0	2.00	1.4	3	0.2	0.00		a

TABLE 2—Continued

Coordinates (J2000.0) (1)	Discoverer Designation (2)	Epoch (1900+) (3)	θ (deg) (4)	ρ (arcsec) (5)	Δm (mag) (6)	n (7)	$O-C$ (deg) (8)	$O-C$ (arcsec) (9)	Reference (10)	Notes (11)
21555+1053.....	Bu 75	88.246	4.2	0.48	0.4	4	1.7	-0.02	Heintz 1996c	^b
		89.840	5.5	0.53	0.4	3	0.3	-0.02		
22280+5742.....	Kr 60	88.676	139.9	3.41	1.6	4	1.5	0.13	Heintz 1986b	
22281+1215.....	Bu 701	89.833	198.1	0.93	1.8	4	8.8	0.36	Costa & Docobo 1982	
22288-0001.....	StF 2909	88.475	206.5	1.81	0.2	8	-0.8	-0.07	Heintz 1984c	^a
		89.796	203.3	1.88	0.2	6	-1.6	-0.02		^a
22300+0426.....	StF 2912	88.522	115.9	0.65	1.1	5	-1.7	-0.04	Zulevic 1988	
		89.833	117.1	0.61	1.0	4	-0.5	-0.05		
22302+2228.....	Hu 388	88.467	50.8	0.45	0.0	4	-1.8	0.10	Costa & Docobo 1983	
22406+0632.....	Hu 494	88.519	321.8	0.38	0.1	4	-3.5	0.04	Heintz 1996b	
22485+3106.....	Bu 1146	89.837	95.5	0.22	1.0	3	-3.5	-0.01	Couteau 1989	
22520+5743.....	A 632	88.461	168.2	0.84	0.7	4	1.9	0.02	Heintz 1991	
22537+4445.....	Bu 382	88.686	211.6	1.01	1.6	4	-1.9	0.03	Muller 1954	
22557+1547.....	Hu 987	89.596	86.5	0.95	0.4	4	-1.2	0.08	Heintz 1984a	
22592+1144.....	Stt 483	89.596	318.8	0.52	0.8	4	3.6	-0.03	Heintz 1996c	
23126+0241.....	A 2298	88.890	108.6	0.16		2	32.4	0.09	Costa & Docobo 1983	
23176+1818.....	Hu 400	89.606	115.0	0.30	1.2	4	-4.1	-0.04	Heintz 1962	
23176-0131.....	Bu 79	88.921	18.4	1.66	1.4	3	-2.3	0.12	Heintz 1962	
23189+0524.....	Bu 80	88.467	328.6	0.76	0.9	4	4.5	0.00	Heintz 1996b	
		89.837	331.7	0.71	0.9	3	4.6	-0.00		
23304+3050.....	Bu 1266	88.787	74.0	0.28	0.0	4	1.5	0.02	Mason & Hartkopf 1998	
23340+3120.....	Bu 720	88.836	265.8	0.61	0.0	4	-2.2	0.09	Baize 1976	
23595+3343.....	StF 3050	88.915	318.2	1.76	0.1	4	-1.1	0.03	Heintz 1996b	

^a Notes on individual systems:

00593-0040 Residuals to Heintz 1996b are $-1^{\circ}7$ and $0^{\circ}01$.
04076+3804 Residuals to Docobo & Costa 1985 are $2^{\circ}4$ and $0^{\circ}13$.
04159+3142 Residuals to Scardia 1983c are $0^{\circ}4$ and $-0^{\circ}02$.
04301+1538 Residuals to Kuiper 1937 are $1^{\circ}3$ and $-0^{\circ}16$.
05387-0236 Residuals to Heintz 1997 are $-5^{\circ}1$ and $0^{\circ}00$.
05482+0137 Residuals to de Freitas Mourão, Tavares, & Nunes 1982 are $4^{\circ}1$ and $0^{\circ}05$.
05558+3656 Residuals to Heintz 1996b are $-2^{\circ}0$ and $-0^{\circ}01$.
06041+2316 Residuals to Heintz 1986b are $-0^{\circ}5$ and $0^{\circ}05$.
06575+0253 Residuals to orbit 2 of Heintz 1975 are $13^{\circ}7$ and $0^{\circ}07$.
07346+3153 Residuals to Docobo, Costa, & Ling 1985 for these two measures are $1^{\circ}2$, $0^{\circ}03$ and $1^{\circ}0$, $0^{\circ}10$, respectively.
08316+3458 Residuals to Baize 1989 for these two measures are $-11^{\circ}9$, $0^{\circ}07$ and $-7^{\circ}9$, $0^{\circ}11$, respectively.
09006+4147 Residuals to Heintz 1997 are $-1^{\circ}1$ and $0^{\circ}04$.
11136+5525 Residuals to Docobo & Ling 1994a are $-2^{\circ}0$ and $-0^{\circ}05$.
11182+3132 Residuals to Heintz 1996a for these three measures are $-1^{\circ}8$, $-0^{\circ}04$, $-2^{\circ}7$, $0^{\circ}05$, and $-1^{\circ}1$, $-0^{\circ}02$, respectively.
12160+4807 Residuals to Couteau 1986 are $6^{\circ}8$ and $0^{\circ}05$, while residuals to Scardia 1993 are $-0^{\circ}8$ and $0^{\circ}01$.
12422+2622 Residuals to Costa & Docobo 1983 are $6^{\circ}1$ and $0^{\circ}01$, while residuals to Soulie 1986 are $5^{\circ}3$ and $-0^{\circ}01$.
15396+7959 Residuals to Wierzbinski 1957c are $-1^{\circ}9$ and $-0^{\circ}09$.
16169+0113 Residuals to Popovic & Pavlovic 1995 are $-2^{\circ}2$ and $0^{\circ}06$.
16413+3006 Residuals to Baize 1984 are $-3^{\circ}0$ and $-0^{\circ}06$.
18355+2336 Residuals to Arend 1951 are $2^{\circ}8$ and $0^{\circ}01$.
18413+3018 Residuals to Cester 1991 are $-1^{\circ}5$ and $-0^{\circ}00$.
20329+1357 Residuals to Starikova 1983 are $-3^{\circ}3$ and $-0^{\circ}01$.
21148+3803 Residuals to Heintz 1970 are $-7^{\circ}1$ and $0^{\circ}03$, while the residuals to van Biesbroeck 1940 are $6^{\circ}0$ and $0^{\circ}04$.
21441+2845 Residuals to Docobo & Costa 1987 for these two measures are $2^{\circ}2$, $-0^{\circ}07$ and $1^{\circ}2$, $-0^{\circ}01$, respectively.
22288-0001 Residuals to Costa & Docobo 1982 for these two measures are $-0^{\circ}1$, $0^{\circ}10$ and $-0^{\circ}6$, $0^{\circ}15$, respectively.

^b A new orbit of this system is in progress.

TABLE 3
MEAN ORBIT RESIDUALS FOR ORBITS OF DIFFERENT GRADES

Grade	$(O-C)_{\theta}$ (deg)	$(O-C)_{\rho}$ (arcsec)	n
1: Definitive.....	2.1	0.04	44
2: Good.....	1.6	0.03	36
3: Reliable.....	3.4	0.04	54
4: Preliminary.....	3.0	0.04	59
5: Indeterminate.....	3.2	0.09	36

- de Freitas Mourão, R. R., Tavares, O. C., & Nunes, M. R. 1982, *Rev. Mexicana Astron. Astrofis.*, 5, 135
- Docobo, J. A., & Costa, J. M. 1985, *Circ. d'Inf.*, No. 95
- . 1987, *Circ. d'Inf.*, No. 103
- . 1989, *Circ. d'Inf.*, No. 107
- . 1990, *PASP*, 102, 1400
- Docobo, J. A., Costa, J. M., & Ling, J. F. 1985, *Circ. d'Inf.*, No. 96
- Docobo, J. A., & Ling, J. F. 1991, *Circ. d'Inf.*, No. 115
- . 1994a, *Circ. d'Inf.*, No. 122
- . 1994b, *Circ. d'Inf.*, No. 124
- . 1997, *Circ. d'Inf.*, No. 132
- Docobo, J. A., & Prieto, C. 1993, *Circ. d'Inf.*, No. 120
- Douglass, G. G., Hindsley, R. B., & Worley, C. E. 1997, *ApJS*, 111, 289
- Erceg, V. 1978, *Bull. Obs. Beograd*, No. 129, 14
- . 1984, *Bull. Obs. Beograd*, No. 134, 54
- Gasteyer, C. 1954, *AJ*, 59, 243
- Giannuzzi, M. A. 1956, *Oss. Astron. Roma Monte Mario Contrib. Sci.*, No. 226
- Hall, R. G. 1949, *AJ*, 54, 102
- Harrington, R. S. 1987, *Circ. d'Inf.*, No. 101
- Hartkopf, W. I., Mason, B. D., & McAlister, H. A. 1996, *AJ*, 111, 370
- Hartkopf, W. I., McAlister, H. A., & Franz, O. G. 1989, *AJ*, 98, 1014
- Heintz, W. D. 1959, *Astron. Nachr.*, 285, 255
- . 1962, *Veröff. Sternw. München*, 5, 135
- . 1963, *Veröff. Sternw. München*, 5, 247
- . 1965, *Veröff. Sternw. München*, 7, 7
- . 1969, *A&A*, 2, 169
- . 1970, *AJ*, 75, 848
- . 1973, *AJ*, 78, 208
- . 1974, *AJ*, 79, 819
- . 1975, *ApJS*, 29, 331
- . 1976, *ApJ*, 208, 474
- . 1978, *ApJS*, 37, 71
- . 1979, *ApJS*, 41, 549
- . 1981, *PASP*, 93, 90
- . 1982, *A&AS*, 47, 569
- . 1984a, *AJ*, 89, 1063
- . 1984b, *A&AS*, 56, 5
- . 1984c, *ApJ*, 284, 806
- . 1986a, *A&AS*, 64, 1
- . 1986b, *A&AS*, 65, 411
- Heintz, W. D. 1988a, *PASP*, 100, 834
- . 1988b, *A&AS*, 72, 543
- . 1988c, *JRASC*, 82, 140
- . 1990, *A&AS*, 82, 65
- . 1991, *A&AS*, 90, 311
- . 1994, *AJ*, 108, 2338
- . 1995, *ApJS*, 99, 693
- . 1996a, *AJ*, 111, 408
- . 1996b, *AJ*, 111, 412
- . 1996c, *ApJS*, 105, 475
- . 1997, *ApJS*, 111, 335
- Hopmann, J. 1960, *Mitt. Univ.-Sternw. Wien*, 10, 198
- . 1964, *Ann. Univ.-Sternw. Wien*, 26, 25
- . 1965, *Mitt. Univ.-Sternw. Wien*, 12, 201
- Houser, J. L. 1987, *PASP*, 99, 509
- Kiselev, A. A., & Kiyayeva, O. V. 1988, *Ap&SS*, 142, 181
- Kuiper, G. P. 1937, *ApJ*, 86, 166
- Laques, P., & Morel, P. J. 1971, *A&A*, 10, 476
- Ling, J. F. 1985, *Circ. d'Inf.*, No. 96
- Ling, J. F., & Prieto, C. 1990, *Circ. d'Inf.*, No. 110
- Luyten, W. J. 1934, *AJ*, 43, 105
- Mason, B. D., & Hartkopf, W. I. 1998, *Circ. d'Inf.*, No. 134
- Mason, B. D., McAlister, H. A., & Hartkopf, W. I. 1996, *AJ*, 112, 276
- Mason, B. D., McAlister, H. A., Hartkopf, W. I., & Shara, M. M. 1995, *AJ*, 109, 332
- Morel, P. J. 1970, *A&AS*, 1, 115
- Muller, P. 1952, *Bull. Astron. Paris*, 16, 208
- . 1954, *J. Obs.*, 37, 71
- Popovic, G. M. 1972, *Bull. Obs. Belgrade*, 29, 31
- . 1987, *Bull. Obs. Belgrade*, 82, 137
- Popovic, G. M., & Catovic, Z. 1993, *Bull. Obs. Belgrade*, 148, 49
- Popovic, G. M., & Pavlovic, R. 1995, *Circ. d'Inf.*, No. 125
- Rabe, W. 1948, *Astron. Nachr.*, 276, 56
- Scardia, M. 1982, *Circ. d'Inf.*, No. 88
- . 1983a, *Astron. Nachr.*, 304, 29
- . 1983b, *Circ. d'Inf.*, No. 89
- . 1983c, *A&AS*, 51, 417
- . 1983d, *Astron. Nachr.*, 304, 257
- . 1983e, *Circ. d'Inf.*, No. 90
- . 1984a, *Circ. d'Inf.*, No. 92
- . 1984b, *Astron. Nachr.*, 305, 127
- . 1985, *A&AS*, 59, 455
- . 1993, *Circ. d'Inf.*, No. 120
- Siegrist, L. 1951, *Urania*, 36, 155
- Soulie, E. J. 1986, *A&A*, 164, 408
- Starikova, G. A. 1983, *AZh Pisma*, 9, 358 (English transl. *Soviet Astron. Lett.*, 9, 189)
- . 1985, *Tr. Astron. Inst. Sternberg*, 57, 243
- Symms, L. S. T. 1964, *Circ. d'Inf.*, No. 33
- Tokovinin, A. A. 1986, *AZh Pisma*, 12, 480 (English transl. *Soviet Astron. Lett.*, 12, 201)
- Valbousquet, A. 1981, *Circ. d'Inf.*, No. 83
- van Biesbroeck, G. 1940, *AJ*, 48, 169
- van den Bos, W. H. 1933, *Union Obs. Circ.*, 3, 388
- . 1960, *Union Obs. Circ.*, 6, 339
- van Dessel, E. 1976, *A&AS*, 26, 415
- Wierzbinski, S. 1957a, *Acta Astron.*, 7, 119
- . 1957b, *Acta Astron.*, 7, 137
- . 1957c, *Acta Astron.*, 7, 212
- Worley, C. E., & Douglass, G. G. 1997, *A&AS*, 125, 523
- Worley, C. E., & Heintz, W. D. 1983, *Fourth Catalog of Orbits of Visual Binary Stars* (Publ. US Nav. Obs., Vol. 24, Part 7) (Washington: GPO)
- Worley, C. E., et al. 1998, in preparation
- Zaera, J. A. 1984, *Circ. d'Inf.*, No. 93
- Zulevic, D. J. 1971, *Circ. d'Inf.*, No. 55
- . 1981, *Circ. d'Inf.*, No. 85
- . 1986, *Circ. d'Inf.*, No. 98
- . 1988, *Circ. d'Inf.*, No. 106