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PRECISE POSITIONS OF ASTEROIDS AND COMETS IN 1988

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RESUMEN

Se presentan las posiciones de asteroides y cometas obtenidas durante 1988 con el astrógrafo doble de 40-cms del Centro Astronómico de Yebes (España). La reducción se ha hecho usando el método de dependencias con ocho estrellas de referencia.

ABSTRACT

We present in this paper the positions of minor planets and comets obtained during 1988 with the 40-cm double astrograph at Centro Astronómico of Yebes (Spain). The reductions were made by the dependence methods using eight reference stars.

Key words: **ASTEROIDS – ASTROMETRY – COMETS**

I. INTRODUCTION

The Centro Astronómico of Yebes (Guadalajara, Spain) is participating in photographic observations of asteroids and comets as recommended by IAU Commision No. 20. The purpose of this programme is to obtain precise positions of interesting asteroids and comets, asteroids with uncertain orbital elements, and of newly discovered asteroids and comets.

The asteroids were selected by means of different criteria:

a) Asteroids belong to the Ephemerides of Minor Planets (Leningrad 1988).

b) Minor planets with uncertain ephemerides (marked with a cross in the Leningrad Ephemerides).

c) Objects selected from the list by V.I. Orelskaya, of the Institut of Theoretical Astronomy of Leningrad, where the programme is being carried out (Orelskaya 1974; Batrakov, Izvekov and Vaskevich 1988).

d) Asteroids with few observed oppositions, for which ephemerides were taken from MPCs of 1988.

The observed comets were selected from the Astronomical Telegrams of IAU and MPCs.

The coordinates of asteroids and comets are sent to the Smithsonian Astrophysical Observatory. We publish here the equatorial coordinates of the observed minor planets and comets during the year 1988.

II. MEASUREMENTS AND REDUCTIONS

All the observations were performed with the 40-cm aperture and 2-m focal length double astrograph at Centro Astronómico of Yebes. The coordinates of the Observatory are long. = $12^m\ 21^s$ W, $\phi = 40°\ 31'\ 24''$, h = 930 m. Details about the telescope can be seen in Pascual (1979).

Baked Kodak 103aO and IIaO plates were used throughout. On each plate we have three exposures separated by one interval of ten minutes. Between each exposure we increase $\delta = 1'\ 30''$ between the first and second, $\delta = 1'$ between the second and the last. For each plate eight reference stars were chosen. The coordinates and proper motions of these stars were taken from the SAO Catalogue for the epoch 1950.0.

The measurements are performed on the Ascorecord Zeiss Coordinatograph with an estimated precision of one tenth of a micron (0.1 μm). The observations have been reduced using two methods: dependences method in order to provide the stellar dependences and the least squares method to derive the residuals of the reference stars.

III. RESULTS

The results for the asteroids and comets are presented in Tables 1, 2 and 3. The first column gives the number and name (or the provisional designation) of the object; the second column gives the date and time (in UT) of the observation; the third and fourth columns give the topocentric right ascension and declination for 1950.0, respectively; and the last two columns give the residuals

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TABLE 1

POSITIONS OF MINOR PLANETS

Object		Date	(U.T.)	R.A. (1950) h m s	Dec. ° ′ ″	Residuals s	″
1	CERES	1988	7 12.14557	0 22 3.42	-11 18 4.3	-.047	0.10
1		1988	7 12.14973	0 22 3.52	-11 18 4.0	-.047	0.88
1		1988	7 12.15388	0 22 3.60	-11 18 5.4	-.075	0.06
1		1988	7 13.15288	0 22 28.28	-11 20 .8	-.067	0.25
1		1988	7 13.15634	0 22 28.39	-11 20 .9	-.033	0.60
1		1988	7 13.15980	0 22 28.45	-11 20 1.9	-.053	0.08
1		1988	9 8.98602	0 10 25.35	-16 12 59.6	-.382	1.97
1		1988	9 8.99295	0 10 25.00	-16 12 59.6	-.407	1.48
1		1988	9 8.99988	0 10 24.70	-16 13 1.4	-.377	2.15
1		1988	10 19.98224	23 39 10.84	-18 10 26.3	-.000	-.17
1		1988	10 19.99343	23 39 10.43	-18 10 25.2	-.040	.14
1		1988	10 20.00532	23 39 10.09	-18 10 25.0	.012	-.50
1		1988	12 12.81090	23 42 14.90	-13 27 24.6	-.037	.08
1		1988	12 12.81783	23 42 15.18	-13 27 21.2	-.000	.04
1		1988	12 12.82475	23 42 15.48	-13 27 17.0	.057	.81
1		1988	12 12.93735	23 42 19.48	-13 26 19.9	.089	1.87
1		1988	12 12.94289	23 42 19.52	-13 26 19.1	-.073	-.10
1		1988	12 12.94843	23 42 19.75	-13 26 16.3	-.042	-.06
1		1988	12 13.93375	23 42 55.75	-13 18 5.7	-.092	-2.11
1		1988	12 13.94068	23 42 56.09	-13 18 2.1	-.002	-1.80
1		1988	12 13.94760	23 42 56.38	-13 17 58.0	.035	-1.02
2	PALLAS	1988	7 12.00250	20 29 45.31	17 58 18.9	.067	.48
2		1988	7 12.00943	20 29 44.99	17 58 18.3	.054	1.00
2		1988	7 12.01635	20 29 44.68	17 58 16.8	.053	.53
2		1988	7 13.00877	20 29 1.26	17 55 37.0	.005	.50
2		1988	7 13.01500	20 29 .93	17 55 36.2	-.046	.75
2		1988	7 13.02124	20 29 .68	17 55 35.3	-.016	.94
2		1988	9 8.90673	19 52 .62	9 20 48.5	.257	1.65
2		1988	9 8.91435	19 52 .55	9 20 43.3	.307	2.00
2		1988	9 8.92266	19 52 .39	9 20 36.6	.286	1.48
2		1988	10 19.89544	19 58 43.97	1 49 55.5	-.017	-.47
2		1988	10 19.90236	19 58 44.21	1 49 52.0	.006	-.31
2		1988	10 19.90929	19 58 44.41	1 49 48.6	-.012	-.08
4	VESTA	1988	2 16.07827	7 51 26.30	25 33 20.8	-.095	-.65
4		1988	2 16.08519	7 51 26.02	25 33 23.2	-.048	.41
4		1988	2 16.09212	7 51 25.71	25 33 24.6	-.044	.42
4		1988	2 19.05311	7 49 20.13	25 43 11.5	-.121	1.99
4		1988	2 19.06003	7 49 19.79	25 43 12.7	-.172	2.04
4		1988	2 19.06696	7 49 19.49	25 43 13.1	-.190	1.22
4		1988	3 15.92948	7 42 59.41	26 20 3.2	.043	1.85
4		1988	3 15.93848	7 42 59.52	26 20 2.3	.073	1.04
4		1988	3 15.94749	7 42 59.55	26 20 1.7	.019	.48
4		1988	3 18.08780	7 43 26.86	26 19 38.8	.022	.44
4		1988	3 18.09335	7 43 26.95	26 19 39.0	.032	.79
4		1988	3 18.09889	7 43 27.05	26 19 38.7	.047	.67
4		1988	4 20.98873	8 7 14.35	25 18 33.7	.149	-.60
4		1988	4 20.99566	8 7 14.76	25 18 32.8	.108	-.13
4		1988	4 21.00258	8 7 15.19	25 18 31.6	.091	10
4		1988	4 21.93302	8 8 16.05	25 15 29.5	.148	.55
4		1988	4 21.93995	8 8 16.47	25 15 27.9	.109	.40
4		1988	4 21.94687	8 8 16.97	25 15 25.8	.164	-.27
6	HEBE	1988	12 14.02055	8 52 22.36	8 16 42.4	-.024	-.00
6		1988	12 14.02748	8 52 22.27	8 16 43.7	-.030	-.05
6		1988	12 14.03440	8 52 22.16	8 16 45.8	-.061	.72
6		1988	12 14.12120	8 52 21.15	8 17 2.1	-.060	.23
6		1988	12 14.12813	8 52 21.04	8 17 3.0	-.29	-.08
6		1988	12 14.13505	8 52 20.92	8 17 4.8	-.20	-.10
11	PARTHENOPE	1988	2 16.18977	13 46 55.80	-5 14 56.0	.011	-.25
11		1988	2 16.19669	13 46 55.94	-5 14 55.4	.060	-.20
11		1988	2 16.20362	13 46 55.99	-5 14 55.3	.019	-.74
11		1988	2 19.17604	13 47 31.86	-5 9 50.9	.006	-.42
11		1988	2 19.18296	13 47 31.94	-5 9 49.6	.029	.01
11		1988	2 19.19231	13 47 32.03	-5 9 49.0	.049	-.42

TABLE 1 (CONTINUED)

Object		Date	(U.T.)	R.A. (1950) h m s	Dec. ° ′ ″	Residuals s	″
11		1988	3 16.11093	13 42 54.50	-3 30 51.5	.009	.30
11		1988	3 16.11785	13 42 54.26	-3 30 48.9	-.007	.64
11		1988	3 16.12478	13 42 54.03	-3 30 46.8	-.007	.47
11		1988	3 18.13455	13 41 48.82	-3 19 33.1	-.003	-.59
11		1988	3 18.13940	13 41 48.65	-3 19 30.9	.002	-.07
11		1988	3 18.14425	13 41 48.47	-3 19 29.4	-.007	-.22
11		1988	4 21.11789	13 14 22.26	0 5 25.6	.190	.29
11		1988	4 21.12482	13 14 21.88	0 5 27.7	.190	.29
11		1988	4 21.13175	13 14 21.57	0 5 29.5	.191	.29
11		1988	5 18.00435	12 57 4.94	1 19 6.1	.033	.00
11		1988	5 18.01128	12 57 4.73	1 19 5.7	.032	-.01
11		1988	5 18.01820	12 57 4.60	1 19 6.0	.033	-.00
11		1988	5 19.90782	12 56 28.00	1 19 6.5	.186	-.02
11		1988	5 19.91475	12 56 27.79	1 19 6.7	.184	-.01
11		1988	5 19.92167	12 56 27.68	1 19 6.8	.183	-.01
11		1988	7 11.90959	13 14 25.53	-2 29 25.2	-.134	-1.51
11		1988	7 11.91651	13 14 25.95	-2 29 28.1	-.079	-1.39
11		1988	7 11.92344	13 14 26.35	-2 29 30.7	-.044	-.92
11		1988	7 12.91482	13 15 19.30	-2 36 51.6	-.071	-.88
11		1988	7 12.92105	13 15 19.58	-2 36 53.6	-.121	-.11
11		1988	7 12.92728	13 15 19.88	-2 36 56.8	-.151	-.59
13	EGERIA	1988	3 16.03925	6 30 26.87	42 50 17.6	-.037	-.07
13		1988	3 16.04617	6 30 27.22	42 50 14.4	-.038	-.08
13		1988	3 16.05379	6 30 27.81	42 50 11.2	-.037	-.09
18	MELPOMENE	1988	7 12.06731	22 56 26.60	-3 18 6.6	.038	-.48
18		1988	7 12.07424	22 56 26.81	-3 18 7.4	.007	-.53
18		1988	7 12.08117	22 56 27.03	-3 18 8.0	.000	-.46
18		1988	7 13.06210	22 57 1.44	-3 19 55.9	-.005	-.39
18		1988	7 13.06902	22 57 1.65	-3 19 56.2	-.017	.11
18		1988	7 13.07595	22 57 1.85	-3 19 57.3	-.036	-.19
18		1988	9 9.00871	22 46 23.59	-12 56 31.1	-.212	-1.10
18		1988	9 9.01563	22 46 23.33	-12 56 36.5	-.178	-.71
18		1988	9 9.02256	22 46 23.06	-12 56 43.2	-.155	-1.63
18		1988	12 12.81090	23 41 31.87	-12 47 28.5	.099	1.11
18		1988	12 12.81783	23 41 32.45	-12 47 23.8	-.008	1.00
18		1988	12 12.82475	23 41 33.21	-12 47 19.9	.065	.16
18		1988	12 12.93735	23 41 44.28	-12 46 .8	-.123	2.02
18		1988	12 12.94289	23 41 44.90	-12 45 58.2	-.057	.82
18		1988	12 12.94843	23 41 45.42	-12 45 54.2	-.095	.94
18		1988	12 13.93375	23 43 25.34	-12 34 37.8	-.114	.67
18		1988	12 13.94068	23 43 26.08	-12 34 34.2	-.079	-.62
18		1988	12 13.94760	23 43 26.70	-12 34 29.6	-.159	-.82
20	MASSALIA	1988	1 22.03017	4 4 40.74	19 51 22.6	-.027	-.18
20		1988	1 22.03952	4 4 40.95	19 51 23.4	-.027	-.17
20		1988	1 22.04887	4 4 41.18	19 51 24.3	-.026	-.17
25	PHOCEA	1988	12 12.95864	5 8 49.78	-0 47 7.9	-.058	-.17
25		1988	12 12.96557	5 8 49.36	-0 47 9.0	-.044	.66
25		1988	12 12.97250	5 8 48.94	-0 47 12.5	-.023	-.87
25		1988	12 13.06322	5 8 43.18	-0 47 37.2	-.071	-.34
25		1988	12 13.07014	5 8 42.76	-0 47 38.7	-.062	.08
25		1988	12 13.07707	5 8 42.34	-0 47 40.4	-.039	.33
25		1988	12 14.04248	5 7 43.19	-0 52 2.1	-.40	.30
25		1988	12 14.04994	5 7 42.95	-0 52 3.1	-.51	.15
25		1988	12 14.05633	5 7 42.41	-0 52 5.0	-.63	.10
39	LAETITIA	1988	1 21.81687	0 38 58.20	-4 3 3.9	.818	-.81
39		1988	1 21.82726	0 38 59.06	-4 2 57.2	.820	-.79
39		1988	1 21.83764	0 38 59.88	-4 2 52.1	.821	-.80
39		1988	12 13.99920	8 3 20.87	9 4 15.9	-.017	-.23
39		1988	12 14.00612	8 3 20.63	9 4 15.8	-.045	-.68
39		1988	12 14.01305	8 3 20.47	9 4 17.0	-.005	.26
39		1988	12 14.10123	8 3 17.86	9 4 21.2	.021	.27
39		1988	12 14.10816	8 3 17.62	9 4 21.4	-.011	.16
39		1988	12 14.11509	8 3 17.36	9 4 22.3	-.056	.80

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TABLE 1 (CONTINUED)

Object	Date	(U.T.)	R.A. (1950)	Dec.	Residuals	
			h m s	o ′ ″	s	″
40 HARMONIA	1988	1 21.86777	2 5 13.03	9 45 43.0	.097	1.33
40	1988	1 21.87816	2 5 13.63	9 45 47.6	.032	.77
40	1988	1 21.88855	2 5 14.23	9 45 53.3	-.027	1.42
44 NYSA	1988	1 22.03017	4 14 1.69	17 16 35.9	-.023	-.21
44	1988	1 22.03952	4 14 1.78	17 16 38.5	-.023	-.20
44	1988	1 22.04887	4 14 1.92	17 16 40.4	-.023	-.20
59 ELPIS	1988	4 21.11789	13 11 29.89	0-19 3.5	-.033	.13
59	1988	4 21.12482	13 11 29.54	0-19 2.8	-.034	.10
59	1988	4 21.13175	13 11 29.34	0-18 59.9	-.033	.10
59	1988	5 18.00435	12 56 28.53	1 32 23.0	-.004	-.02
59	1988	5 18.01128	12 56 28.31	1 32 23.6	-.006	-.02
59	1988	5 18.01820	12 56 28.24	1 32 26.0	-.005	.01
59	1988	5 19.90782	12 55 53.92	1 35 51.2	-.006	-.04
59	1988	5 19.91475	12 55 53.78	1 35 53.1	-.007	-.01
59	1988	5 19.92167	12 55 53.52	1 35 54.4	-.009	-.00
148 GALLIA	1988	3 16.00981	9 49 10.21	19 21 43.3	.118	.43
148	1988	3 16.01674	9 49 9.96	19 21 47.4	.105	.98
148	1988	3 16.02367	9 49 9.71	19 21 51.1	.089	1.17
148	1988	3 18.03448	9 48 7.31	19 38 35.2	.167	.32
148	1988	3 18.04140	9 48 7.09	19 38 38.5	.166	.30
148	1988	3 18.04833	9 48 6.89	19 38 41.6	.173	.04
148	1988	5 17.91847	9 58 46.25	22 7 2.5	.147	-.06
148	1988	5 17.92540	9 58 46.52	22 7 2.0	.110	.28
148	1988	5 17.93233	9 58 46.85	22 7 1.6	.135	.73
148	1988	5 19.88150	10 0 16.39	22 2 57.2	.164	.70
148	1988	5 19.88843	10 0 16.69	22 2 57.3	.137	1.69
148	1988	5 19.89536	10 0 16.85	22 2 54.7	-.021	.05
182 ELSA	1988	5 19.10897	16 59 18.59	-20 51 20.9	.006	-.47
230 ATHAMANTIS	1988	5 19.10897	16 58 40.85	-20 12 10.3	-.026	.20
269 JUSTITIA	1988	7 11.94248	16 18 23.45	-12 25 40.1	.171	1.62
269	1988	7 12.94321	16 18 23.22	-12 30 21.1	.222	1.75
324 BAMBERGA	1988	1 22.06411	5 46 55.58	36 31 .3	-.015	.21
324	1988	1 22.07103	5 46 55.36	36 30 57.4	-.016	.22
324	1988	1 22.07796	5 46 55.16	36 30 54.2	-.015	.22
324	1988	1 23.05411	5 46 24.89	36 23 9.6	-.019	.29
324	1988	1 23.06103	5 46 24.65	36 23 5.8	-.020	.28
324	1988	1 23.06796	5 46 24.49	36 23 3.1	-.019	.29
386 SIEGENA	1988	4 21.99535	12 29 20.35	9 52 57.5	-.028	-.51
389 INDUSTRIA	1988	7 12.02351	21 2 49.87	-11 35 21.3	-.045	-.98
389	1988	7 12.03044	21 2 49.51	-11 35 21.0	-.081	-.85
389	1988	7 12.03736	21 2 49.23	-11 35 20.6	-.040	-.66
389	1988	7 13.04432	21 2 3.10	-11 34 56.2	-.016	-.86
389	1988	7 13.05056	21 2 2.79	-11 34 56.2	-.030	-.97
389	1988	7 13.05679	21 2 2.54	-11 34 55.7	.016	-.64
433 EROS	1988	7 12.13778	0 39 39.00	13 3 8.3	-.016	-.04
433	1988	7 13.14682	0 40 58.40	13 21 15.1	-.014	-.02
480 HANSA	1988	10 19.95407	23 4 12.24	21 12 42.6	-.083	.05
480	1988	10 19.96031	23 4 12.11	21 12 37.8	-.101	.20
480	1988	10 19.96792	23 4 12.05	21 12 32.6	-.027	.99
552 SIGELINDE	1988	12 12.85130	4 48 46.90	24 35 52.2	.080	.04
552	1988	12 13.00712	4 48 38.66	24 35 23.1	.074	.05
552	1988	12 13.97531	4 47 49.18	24 32 15.3	.065	-.01
704 INTERAMNIA	1988	2 19.12306	12 21 54.99	-26 10 42.9	.018	1.00
704	1988	2 19.13067	12 21 54.74	-26 10 43.5	-.017	1.73
704	1988	2 19.13829	12 21 54.57	-26 10 46.4	.034	.22
971 ALSATIA	1988	5 18.06772	16 43 34.76	-16 16 35.7	.035	.30
971	1988	5 19.98608	16 41 48.86	-16 18 54.7	.016	.28
1036 GANYMED	1988	5 17.89701	11 16 58.05	-11 43 19.1	-.010	-.08
1036	1988	5 19.94210	11 16 49.72	-11 29 17.4	2.637	.10
1251 HEDERA	1988	5 18.03690	13 13 8.09	0 39 27.8	.008	-.12
1417 WALINSKIA	1988	4 21.99535	12 29 16.12	10 0 26.9	-.028	-.24
1685 TORO	1988	7 12.04844	22 30 9.58	9 42 19.8	.007	-.23
1685	1988	7 12.05814	22 30 11.38	9 43 2.4	.008	-.23
1685	1988	7 13.02839	22 33 6.52	10 55 54.7	.005	-.30
1685	1988	7 13.03740	22 33 8.10	10 56 33.9	.004	-.34
1980 TEZCATLIPOCA	1988	6 16.98858	16 56 44.33	-1 58 28.9	.035	-1.08

TABLE 2

POSITIONS OF MINOR PLANETS WITH UNCERTAIN EPHEMERIDES

Object	Date	(U.T.)	R.A. (1950)	Dec.	Residuals	
			h m s	o ′ ″	s	″
879x RICARDA	1988	2 16.12328	10 33 30.25	-11 22 24.8	.030	1.33
879x	1988	2 19.09466	10 30 46.04	-11 19 12.7	-.047	-.40
1222x TINA	1988	6 17.01247	18 44 33.90	-5 22 13.0	-.017	-.16
1222x	1988	6 21.08499	18 41 9.06	-4 28 46.4	-.105	.37
1222x	1988	7 11.98507	18 22 26.29	-0 53 13.1	.018	.01
1222x	1988	7 12.99792	18 21 36.22	-0 45 48.4	.015	.08
1978x PATRICE	1988	12 12.85130	4 45 43.52	25 15 56.7	.057	-.12
1978x	1988	12 13.00712	4 45 31.48	25 15 52.7	.045	-.12
1978x	1988	12 13.97531	4 44 20.18	25 15 20.3	.022	-.20
2050x FRANCIS	1988	3 16.17395	13 33 41.60	42 5 17.7	.101	-1.62
2050x	1988	3 18.18061	13 31 44.75	42 20 11.9	.077	-1.27
2260x NEOPTOLEMUS	1988	1 21.96750	5 41 46.67	25 50 1.6	-.056	.19
3057x MALAREN	1988	3 18.11551	12 57 5.44	7 53 32.2	.091	-.85
3057x	1988	3 16.14694	12 58 42.91	7 41 49.3	.108	-1.13
3252x (1981 EM4)	1988	12 12.89562	5 28 19.33	42 21 18.0	.063	.14
3252x	1988	12 13.04071	5 28 7.67	42 20 54.6	.045	.14
3252x	1988	12 14.07573	5 26 49.92	42 17 56.4	.009	.09
3353x JARVIS	1988	5 19.10897	17 6 8.94	-21 52 29.8	.055	-.20

TABLE 3

POSITIONS OF COMETS

Object	Date	(U.T.)	R.A. (1950)	Dec.	Residuals	
			h m s	o ′ ″	s	″
Tempel 2 (87g)	1988	5 19.13875	15 57 19.89	3 46 4.8	-.043	.69
Tempel 2 (87g)	1988	5 20.06988	15 56 28.70	3 48 44.9	-.047	.89
Tempel 2 (87g)	1988	7 12.97715	15 24 51.67	-4 4 57.3	-.302	-.64
Borrelly (87p)	1988	1 21.84942	2 48 7.92	36 16 19.8	-.019	.73
Borrelly (87p)	1988	1 21.94083	2 48 17.00	36 19 41.3	-.028	.70
Borrelly (87p)	1988	1 22.82453	2 49 51.22	36 52 23.2	-.024	.94
Borrelly (87p)	1988	1 22.83076	2 49 51.91	36 52 33.3	-.023	.88
Borrelly (87p)	1988	1 22.83630	2 49 52.21	36 52 42.6	-.028	.84
Borrelly (87p)	1988	2 15.99031	3 47 40.84	47 51 4.9	-.043	.31
Borrelly (87p)	1988	2 16.04849	3 47 51.73	47 52 16.9	-.046	.21
Borrelly (87p)	1988	3 15.97744	5 26 22.35	53 16 43.1	-.073	.23
Borrelly (87p)	1988	3 18.01578	5 33 55.44	53 23 45.2	-.038	.04
Bradfield (87s)	1988	1 21.79159	1 21 31.67	25 19 43.4	.169	-.88
Bradfield (87s)	1988	1 21.85738	1 21 14.45	25 20 6.5	-.408	-.18
Bradfield (87s)	1988	1 22.90244	1 26 2.36	25 14 19.5	-.178	-1.05
Bradfield (87s)	1988	1 22.91005	1 26 4.38	25 14 15.7	-.170	-1.07
Bradfield (87s)	1988	1 22.91767	1 26 5.72	25 13 22.4	-.188	-1.92
Bradfield (87s)	1988	2 15.96296	2 45 32.97	23 20 14.8	-.094	.11
McNaught(87b1)	1988	4 21.90878	3 8 47.89	63 48 21.1	-.019	-1.00
Liller (88a)	1988	4 21.87173	1 38 54.08	56 27 18.9	.345	-.32
Liller (88a)	1988	4 21.87727	1 38 56.01	56 27 52.1	.353	-.14
Liller (88a)	1988	4 21.88039	1 38 54.09	56 27 30.4	.307	-.72
Liller (88a)	1988	4 21.88558	1 38 52.68	56 26 55.2	.261	-1.67
Liller (88a)	1988	5 17.97925	7 58 37.34	73 25 55.6	.001	3.23
Liller (88a)	1988	5 17.98617	7 58 44.87	73 25 36.6	-.006	3.17
Liller (88a)	1988	5 17.99310	7 58 52.89	73 25 19.8	-.006	3.16
Liller (88a)	1988	5 19.12335	8 19 45.78	72 34 55.6	.085	-.75
Liller (88a)	1988	5 19.14313	8 20 18.64	72 33 26.2	.285	-1.37
Liller (88a)	1988	6 16.93144	11 25 2.64	41 43 49.2	.026	-.45
Liller (88a)	1988	6 16.93802	11 25 3.71	41 43 27.9	.029	-.44
Liller (88a)	1988	7 11.89712	12 7 19.12	23 9 53.0	-.008	-.43
Liller (88a)	1988	7 12.89681	12 8 38.82	22 35 23.8	-.006	-.43

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