SUPPLEMENT

Comet astrometry made at the Skalnaté Pleso Observatory in the years 1997 – 1999

J. Svoreň

Astronomical Institute of the Slovak Academy of Sciences
059 60 Tatranská Lomnica, The Slovak Republic

Received: February 3, 2002

Abstract. The paper presents the results of position photographing of comets carried out at the Skalnaté Pleso Observatory since 1997 to 1999. A total of 111 observations of 9 comets are given.

Key words: comets – astrometry

1. Introduction

The presented paper is a continuation of the previous papers which gave the results of positional observations of comets made at the Skalnaté Pleso Observatory (the last paper of this series: Svoreň; 2001) and contains positional comet observations made in the years 1997 – 1999.

The article contains the last photographically obtained cometary positions at the Skalnaté Pleso Observatory. In 1999 a CCD camera was installed and both the methods (photography and CCD) were used. Since January 2000 CCD astrometric observations are in disposal only.

The observations were made with a 0.3-m f/5 Zeiss astrograph. The reduction constants of the Skalnaté Pleso astrograph are as follows:

$\lambda = -\ 1^h\ 20^m\ 58.70^s$,
$\varphi = +49^\circ\ 11'\ 20.0''$,
h = 1783 m m.s.l.,
$\rho = 0.99836$ of the equatorial radius of the Earth.

The comets were photographed on ORWO plates with ZU 21 emulsion, dimensions 9x12 cm, which roughly correspondens to field of 3°x 4°. The reference stars required to compute positions using Schlesinger's method of dependences, from two independent triangles were selected from the Star Catalog of the Smithsonian Astrophysical Observatory (1966). The differences between independent determination of the equatorial coordinates, given for each poosition, provide some information about the accuracy of the measuring (but not about the accuracy of the object position). The rectangular coordinates of the reference stars

SUPPLEMENT

and the comets were measured with the aid of instrument for measuring coordinates produced by Zeiss (Ascoremat E-60).

A total of 111 accurate positions of 9 comets, arranged according to the new system designation, are given. The list of collaborators is given, together with their share in photographing, measuring and reducing the positions.

2. Conversion from eqn. B1950.0 to eqn. J2000.0

The reference stars were selected from the Smithsonian Astrophysical Observatory Star Catalog(1966). The positions were measured in B1950.0 system and then converted to J2000.0 following the formulas published by System Transition Committee of the IAU Commission 20 (Yeomans, 1990). Conversion from eqn. B1950.0 to eqn. J2000.0 is as follows:

Let α_0 and δ_0 are object's right ascension and declination referred to 1950.0 system. Then the calculated rectangular components of the object's position vector $\mathbf{r_0}$ referred to 1950.0 system are:

$$r_{0x} = cos\alpha_0 \;\; cos\delta_0 \tag{1}$$
$$r_{0y} = sin\alpha_0 \;\; cos\delta_0 \tag{2}$$
$$r_{0z} = sin\delta_0 \tag{3}$$

The astrographic position vector $\mathbf{r_1}$ is formed to remove the effects of elliptical aberration:

$$r_{1x} = r_{0x} - A_x + B\ r_{0x} \tag{4}$$
$$r_{1y} = r_{0y} - A_y + B\ r_{0y} \tag{5}$$
$$r_{1z} = r_{0z} - A_z + B\ r_{0z} \tag{6}$$

where B is a scalar product of the vector transpose to $\mathbf{r_0}$ and the vector $\mathbf{A}$, i.e.

$$B = r_{0x}\ A_x + r_{0y}\ A_y + r_{0z}\ A_z \tag{7}$$

and A_x, A_y, A_z are the rectangular components of the vector $\mathbf{A}$:

$$A_x = -1.62557 \times 10^{-6}$$
$$A_y = -0.31919 \times 10^{-6}$$
$$A_z = -0.13843 \times 10^{-6}$$

If the t is Julian time of the observation, then the Julian centuries from 1950 epoch to the observation time can be calculated as

$$T = (t - 2433282.423)\ /\ 36525 \tag{8}$$

The rectangular components of the object's position vector **r** referred to 2000.0 system are:

$$r_x = X_x\ r_{1x} + X_y\ r_{1y} + X_z\ r_{1z} \tag{9}$$
$$r_y = Y_x\ r_{1x} + Y_y\ r_{1y} + Y_z\ r_{1z} \tag{10}$$
$$r_z = Z_x\ r_{1x} + Z_y\ r_{1y} + Z_z\ r_{1z} \tag{11}$$

where $X_x, X_y, ..., Z_z$ are the elements of the rotation matrix (Murray, 1989):

$$X_x = +0.9999256794956877 - 0.0026455262 \times 10^{-6}\ \ T$$
$$X_y = -0.0111814832204662 - 1.1539918689 \times 10^{-6}\ \ T$$
$$X_z = -0.0048590038153592 + 2.1111346190 \times 10^{-6}\ \ T$$
$$Y_x = +0.0111814832391717 + 1.1540628161 \times 10^{-6}\ \ T$$
$$Y_y = +0.9999374848933135 - 0.0129042997 \times 10^{-6}\ \ T$$
$$Y_z = -0.0000271625947142 + 0.0236021478 \times 10^{-6}\ \ T$$
$$Z_x = +0.0048590037723143 - 2.1112979048 \times 10^{-6}\ \ T$$
$$Z_y = -0.0000271702937440 - 0.0056024448 \times 10^{-6}\ \ T$$
$$Z_z = +0.9999881946023742 + 0.0102587734 \times 10^{-6}\ \ T$$

The coordinates α, δ in J2000.0 system are calculated using the expressions:

$$\alpha = arctg\frac{r_y}{r_x} + 90.\ (1 - \frac{r_x}{|r_x|}) \tag{12}$$
$$\delta = arctg\ \frac{r_z}{\sqrt{r_x^2 + r_y^2}} \tag{13}$$

3. Positions of comets

The individual columns of the table contain the following:
N - ordinal number of observation,
Date U.T. - date and time of the middle of the exposure,
$R.A._{2000}$ - right ascension for equinox 2000.0 (in h,m,s),
$Decl._{2000}$ - declination for equinox 2000.0 (in °,′, ″),
T - the exposure time in minutes,
A - the difference between independent determinations of R.A. in arc seconds,
B - the difference between independent determinations of Decl. in arc seconds.
Notes: N. 48 and 49 - bad seeing, N. 54 and 55 - poor guiding.

N	Date U.T.	$R.A._{2000}$	$Decl._{2000}$	T	A	B
		Comet C/1995 O1 (Hale-Bopp)				
1	1997 Jan.	17.19653	19 09 17.27	+09 26 20.2	6	0.1	0.6

N	Date U.T.		$R.A._{2000}$	$Decl._{2000}$	T	A	B
			Comet C/1995 O1 (Hale-Bopp) - cont.				
2	1997 Jan.	18.19167	19 11 08.88	+09 47 01.3	4	0.5	0.6
3	1997 Jan.	19.19167	19 13 02.48	+10 08 23.8	4	0.6	0.4
4	1997 Feb.	12.17002	20 11 30.90	+21 32 10.0	5	0.1	0.1
5	1997 Feb.	17.12639	20 28 28.29	+24 41 41.9	4	0.1	0.1
6	1997 Feb.	17.17431	20 28 38.97	+24 43 47.7	4	0.5	0.3
7	1997 Mar.	01.15104	21 22 49.08	+33 24 00.9	5	0.3	0.9
8	1997 Mar.	05.10470	21 46 24.11	+36 23 41.3	6	0.4	0.1
9	1997 Mar.	06.10417	21 52 55.18	+37 08 21.0	4	0.1	0.4
10	1997 Apr.	03.11944	02 06 23.57	+43 41 50.1	6	0.1	0.7
11	1997 Apr.	03.77500	02 12 00.18	+43 23 56.5	6	0.6	0.5
			Comet C/1997 J2 (Meunier-Dupouy)				
12	1997 Aug.	06.90278	12 25 44.34	+67 12 02.3	40	0.6	0.1
13	1997 Aug.	07.84028	12 27 54.38	+67 07 10.7	20	0.1	0.2
14	1997 Aug.	08.81736	12 30 12.56	+67 01 59.7	18	0.6	0.2
15	1997 Aug.	22.81719	13 05 01.98	+65 42 24.8	20	1.0	0.1
16	1997 Aug.	23.81458	13 07 39.52	+65 36 21.8	20	0.6	0.1
17	1997 Aug.	24.82431	13 10 19.54	+65 30 10.1	20	0.8	1.0
18	1998 July	02.97153	22 22 14.43	+26 39 08.9	20	0.3	0.3
19	1998 July	21.89375	22 06 35.02	+22 33 57.5	20	1.0	0.3
20	1998 July	22.90000	22 05 34.32	+22 17 29.5	20	0.2	0.3
21	1998 July	22.94444	22 05 31.73	+22 16 47.8	20	0.4	0.1
22	1998 July	30.86667	21 57 05.53	+19 54 14.1	20	0.3	1.0
23	1998 July	30.93333	21 57 00.99	+19 52 51.6	20	0.1	0.4
24	1998 Aug.	15.88611	21 38 48.11	+14 05 13.3	22	0.4	0.3
			Comet C/1997 T1 (Utsunomiya)				
25	1997 Oct.	28.84375	19 10 26.60	+40 38 28.3	26	0.3	0.1
26	1997 Oct.	31.83333	19 04 44.55	+36 59 33.8	24	0.5	0.5
27	1997 Nov.	01.79583	19 03 11.83	+35 53 10.6	22	0.7	1.0
28	1997 Nov.	04.84514	18 59 03.25	+32 35 19.9	22	0.9	0.6
			Comet C/1998 P1 (Williams)				
29	1999 Jan.	21.89028	11 45 17.81	+13 16 13.9	20	0.5	0.8
30	1999 Jan.	22.90000	11 40 54.93	+14 21 12.6	20	0.4	0.5
31	1999 Jan.	23.95139	11 36 11.26	+15 29 35.0	20	0.2	0.7
32	1999 Jan.	24.96806	11 31 28.44	+16 36 19.2	18	0.5	0.3
33	1999 Jan.	24.99236	11 31 21.01	+16 37 56.3	18	0.7	0.1
			Periodic comet P/1998 U3 (Jager)				
34	1998 Dec.	18.70868	06 50 01.84	+39 44 36.9	20	0.6	0.9
35	1998 Dec.	18.73079	06 50 00.82	+39 44 27.9	20	0.3	0.3

N	Date U.T.		$R.A._{2000}$	$Decl._{2000}$	T	A	B
			Periodic comet P/1998 U3 (Jager) - cont.				
36	1999 Jan.	10.91806	06 29 47.98	+35 54 12.3	20	0.2	0.5
37	1999 Jan.	10.95139	06 29 46.10	+35 53 46.9	20	0.1	0.4
38	1999 Jan.	17.81806	06 24 45.14	+34 21 59.6	20	0.6	0.1
39	1999 Jan.	17.84028	06 24 44.35	+34 21 40.4	20	0.1	0.7
40	1999 Jan.	19.70000	06 23 35.52	+33 55 39.1	20	0.6	0.2
41	1999 Jan.	19.72083	06 23 34.56	+33 55 22.9	20	0.2	0.6
42	1999 Jan.	20.75139	06 22 59.09	+33 40 45.5	20	0.3	0.2
43	1999 Jan.	20.81111	06 22 57.04	+33 39 55.6	20	0.8	0.9
44	1999 Jan.	21.80417	06 22 24.74	+33 25 47.3	20	0.2	0.1
45	1999 Jan.	21.87222	06 22 22.42	+33 24 48.8	20	0.1	0.7
46	1999 Jan.	23.93056	06 21 21.85	+32 55 17.4	20	1.0	0.2
47	1999 Jan.	24.00417	06 21 19.85	+32 54 08.2	20	0.5	0.2
			Comet C/1998 U5 (LINEAR)				
48	1998 Nov.	12.72338	04 28 34.60	+55 43 27.7	30	0.4	0.5
49	1998 Nov.	12.74595	04 27 59.07	+55 46 19.7	30	0.9	0.4
50	1998 Nov.	13.71678	04 00 54.19	+57 37 04.2	10	0.4	0.4
51	1998 Nov.	18.92361	01 01 46.47	+59 10 35.3	14	0.1	0.1
52	1998 Nov.	18.96528	01 00 28.33	+59 07 36.4	14	0.4	0.6
53	1998 Nov.	19.94375	00 31 05.54	+57 44 40.3	12	0.2	0.1
54	1998 Nov.	25.74712	22 43 28.04	+46 14 39.9	15	0.4	0.5
55	1998 Nov.	25.76135	22 43 17.85	+46 12 56.8	15	0.6	0.4
			Comet C/1999 H1 (Lee)				
56	1999 Sep.	03.91528	06 04 34.41	+52 01 45.4	14	0.8	0.7
57	1999 Sep.	06.88125	05 47 39.90	+53 44 49.3	18	0.3	0.4
58	1999 Sep.	06.90764	05 47 29.57	+53 45 46.9	18	0.2	0.4
59	1999 Sep.	11.78229	05 11 03.74	+56 30 11.9	10	0.9	0.7
60	1999 Sep.	11.80012	05 10 53.88	+56 30 49.3	10	0.1	0.5
61	1999 Sep.	12.77616	05 02 02.41	+57 00 53.1	10	0.1	0.3
62	1999 Sep.	12.79444	05 01 51.96	+57 01 26.0	10	0.1	0.8
63	1999 Sep.	15.86111	04 30 04.81	+58 22 47.5	16	0.5	0.5
64	1999 Sep.	15.90694	04 29 33.64	+58 23 50.8	16	0.6	0.8
65	1999 Sep.	29.76250	01 19 58.89	+54 33 29.3	10	0.4	0.3
66	1999 Sep.	29.79074	01 19 38.69	+54 31 36.0	10	0.4	0.1
67	1999 Oct.	01.76007	00 56 01.30	+52 18 59.5	12	0.1	0.1
68	1999 Oct.	01.80881	00 55 27.44	+52 15 22.8	12	0.1	0.4
			Periodic comet 81P/Wild 2				
69	1997 Jan.	07.84097	08 16 57.23	+17 21 01.7	34	1.0	0.4
70	1997 Jan.	07.93264	08 16 53.75	+17 21 23.2	34	0.6	0.7
71	1997 Jan.	08.93681	08 16 17.15	+17 25 15.4	34	0.2	0.6
72	1997 Jan.	11.76921	08 14 26.24	+17 36 53.0	35	0.2	0.2

N	Date U.T.	$R.A._{2000}$	$Decl._{2000}$	T	A	B
		Periodic comet 81P/Wild 2 - cont.				
73	1997 Jan.	11.79688	08 14 24.97	+17 37 01.5	35	0.3	0.8
74	1997 Jan.	12.77182	08 13 44.19	+17 41 15.7	28	0.1	0.2
75	1997 Jan.	13.79711	08 13 00.12	+17 45 52.7	26	0.6	0.4
76	1997 Jan.	13.81933	08 12 59.05	+17 45 59.4	26	0.1	0.3
77	1997 Jan.	14.74572	08 12 18.20	+17 50 14.5	24	0.6	0.3
78	1997 Jan.	16.04861	08 11 18.46	+17 56 25.1	30	0.6	0.6
79	1997 Jan.	17.09097	08 10 30.06	+18 01 26.8	26	0.4	0.9
80	1997 Jan.	17.14028	08 10 27.76	+18 01 40.9	26	0.3	0.6
81	1997 Jan.	30.82361	07 59 08.40	+19 14 54.9	22	0.2	0.6
82	1997 Jan.	30.94306	07 59 02.23	+19 15 34.9	22	0.2	0.6
83	1997 Feb.	02.86875	07 56 41.92	+19 31 51.6	20	0.4	0.2
84	1997 Feb.	02.96736	07 56 36.97	+19 32 24.2	22	0.2	0.6
85	1997 Feb.	03.87500	07 55 55.38	+19 37 24.9	20	0.1	0.2
86	1997 Feb.	03.95625	07 55 51.37	+19 37 52.4	20	0.2	0.8
87	1997 Feb.	07.74404	07 53 07.81	+19 58 25.9	20	0.4	0.8
88	1997 Feb.	09.73322	07 51 49.93	+20 08 57.3	20	0.4	0.1
89	1997 Feb.	11.74884	07 50 38.16	+20 19 16.8	12	0.2	0.5
90	1997 Mar.	01.80955	07 46 54.46	+21 33 18.4	12	0.2	0.2
91	1997 Mar.	05.89722	07 48 05.95	+21 44 01.6	16	0.2	0.8
92	1997 Mar.	05.96042	07 48 07.29	+21 44 09.6	16	0.5	0.6
93	1997 Mar.	09.85347	07 50 01.73	+21 51 57.8	16	0.8	0.7
94	1997 Mar.	09.90069	07 50 03.21	+21 52 02.6	16	0.7	0.6
95	1997 Mar.	11.74653	07 51 13.45	+21 54 52.7	17	0.1	0.8
96	1997 Mar.	11.80116	07 51 15.49	+21 54 57.8	17	0.1	0.7
97	1997 Mar.	12.74456	07 51 55.28	+21 56 10.1	12	0.9	0.6
98	1997 Apr.	24.80313	08 59 21.93	+19 49 04.8	18	0.1	0.7
99	1997 Apr.	24.81806	08 59 24.04	+19 48 57.5	18	0.4	0.5
		Periodic comet 103P/Hartley 2				
100	1997 Dec.	07.67234	21 36 49.12	−09 25 31.3	15	0.3	1.0
101	1997 Dec.	07.69272	21 36 53.89	−09 25 32.1	15	0.9	0.2
102	1997 Dec.	21.69965	22 38 54.56	−08 38 47.8	5	0.4	0.8
103	1997 Dec.	22.73438	22 43 49.00	−08 33 02.8	6	0.7	0.1
104	1997 Dec.	22.76146	22 43 56.85	−08 32 54.1	7	0.8	0.1
105	1997 Dec.	23.69659	22 48 25.05	−08 27 24.6	6	0.2	0.4
106	1997 Dec.	23.71308	22 48 29.58	−08 27 16.9	6	0.2	1.0
107	1997 Dec.	31.69907	23 27 53.48	−07 29 01.8	6	1 0	0.6
108	1997 Dec.	31.71736	23 27 58.80	−07 28 53.6	6	0.3	0.5
109	1998 Jan.	18.70972	01 01 17.71	−04 08 21.7	6	0.2	0.7
110	1998 Jan.	18.72998	01 01 24.09	−04 08 07.5	6	0.1	0.5
111	1998 Jan.	25.75972	01 37 42.68	−02 30 56.6	12	1.0	0.3

4. Reference stars and dependences

The individual columns of the table contain the following:
N - ordinal number of the observation in agreement with the Section 2,
Numbers of reference stars and dependences

N	Numbers of stars and dependences					
1	124306	.40600	104353	.33857	124357	.25543
	124285	.29796	104518	.38365	124382	.31839
2	124316	.32916	104572	.29609	124396	.37475
	104535	.20247	124357	.46322	104591	.33431
3	104572	.32724	124382	.33287	104649	.33989
	124345	.32242	104605	.30380	124444	.37378
4	88231	.10398	88292	.56066	88384	.33536
	88207	.28722	88358	.44166	88384	.27112
5	88674	.47474	88707	.14764	88799	.37762
	88661	.28029	88745	.25827	88759	.46144
6	88674	.42206	88707	.17685	88799	.40109
	88661	.23320	88745	.30115	88759	.46565
7	71197	.37336	71297	.41299	71326	.21365
	71205	.39854	71297	.31032	71321	.29114
8	71579	.27792	71714	.32332	71740	.39876
	71636	.33282	71674	.24737	71744	.41981
9	71740	.35514	71779	.10205	71842	.54281
	71738	.26656	71810	.53350	71829	.19994
10	37736	.28160	37751	.43017	37828	.28823
	37720	.27308	37759	.38418	37826	.34274
11	37820	.35724	37840	.34983	37898	.29293
	37812	.39362	37843	.25214	37894	.35424
12	15774	.27285	15802	.49215	15821	.23500
	15758	.38009	15812	.24400	15820	.37591
13	15774	.33438	15802	.30146	15836	.36416
	15740	.41748	15845	.22966	15852	.35286
14	15774	.29673	15802	.14381	15836	.55946
	15740	.32680	15845	.30120	15852	.37200
15	15941	.36429	16006	.30852	16001	.32719
	15933	.39506	16006	.36313	16022	.24181
16	15941	.18697	16006	.26589	16001	.54714
	15933	.26598	16006	.40513	16022	.32889

N	Numbers of stars and dependences					
17	15955	.32167	16006	.30989	16050	.36844
	15941	.25971	16006	.37444	16043	.36585
18	90438	.25037	90439	.50003	90489	.24960
	90409	.39445	90463	.36787	90499	.23768
19	90212	.22674	90229	.45554	90248	.31772
	90209	.31236	90224	.44022	90278	.24742
20	90193	.36174	90224	.25207	90248	.38619
	90202	.19984	90209	.58531	90271	.21485
21	90193	.37404	90224	.24201	90248	.38395
	90202	.19991	90209	.59519	90271	.20490
22	107500	.41599	90111	.24671	107573	.33730
	107480	.27755	107548	.40590	90143	.31655
23	107500	.44081	90111	.23246	107573	.32673
	107480	.29417	107548	.40974	90143	.29609
24	107278	.44005	107285	.23823	107331	.32172
	107274	.23170	107277	.35872	107329	.40958
25	48077	.19684	67931	.45560	48191	.34756
	48088	.30239	48177	.36319	67975	.33442
26	67744	.28676	67764	.43069	67838	.28255
	67725	.18302	67745	.54984	67887	.26714
27	67707	.40080	67728	.24809	67813	.35111
	67690	.28628	67764	.34622	67776	.36750
28	67626	.43843	67667	.27677	67716	.28480
	67637	.40466	67671	.51117	67740	.08417
29	99745	.12524	99774	.31039	99782	.56437
	99751	.15888	99766	.41425	99784	.42687
30	99706	.35686	99734	.39094	99764	.25220
	99708	.21045	99709	.44467	99774	.34488
31	99675	.40173	99688	.34993	99702	.24834
	99669	.39561	99685	.33640	99712	.26799
32	99622	.33320	99631	.35655	99685	.31025
	99612	.37335	99650	.27673	99675	.34992
33	99622	.32924	99631	.38050	99685	.29026
	99612	.38500	99650	.28935	99675	.32565
34	41336	.31674	59494	.27419	59583	.40907
	41336	.33063	59524	.26240	58566	.40697
35	41336	.31638	59494	.27787	59583	.40575
	41336	.33238	59524	.26512	58566	.40250

N	Numbers of stars and dependences					
36	59087	.37511	59163	.31001	59186	.31488
	59088	.32850	59162	.44425	59179	.22725
37	59087	.38084	59163	.31270	59186	.30646
	59088	.33625	59162	.43773	59179	.22602
38	58979	.21466	59051	.43597	59114	.34937
	58972	.19301	59051	.43268	59102	.37431
39	58979	.21770	59051	.43195	59114	.35035
	58972	.19558	59051	.42931	59102	.37511
40	58972	.32192	59024	.28777	59114	.39031
	58977	.40092	59067	.37307	59121	.22601
41	58972	.32585	59024	.28405	59114	.39010
	58977	.40150	59067	.37661	59121	.22189
42	58961	.23048	59040	.24487	59049	.52465
	58977	.30069	59004	.24903	59083	.45028
43	58961	.23534	59040	.24940	59049	.51526
	58977	.29964	59004	.25744	59083	.44292
44	58961	.31274	59040	.32906	59049	.35820
	58977	.27575	59004	.40065	59083	.32360
45	58961	.31831	59040	.33444	59049	.34725
	58977	.27436	59004	.41049	59083	.31515
46	58972	.43684	59014	.33056	59067	.23260
	58977	.37279	59004	.35636	59083	.27085
47	58972	.43393	59014	.34478	59067	.22129
	58955	.38567	59019	.33534	59060	.27899
48	24562	.35914	24654	.41546	24710	.22540
	24587	.33871	24640	.22533	24664	.43596
49	24562	.38709	24654	.44418	24710	.16873
	24587	.43558	24640	.18330	24664	.38112
50	24303	.32468	24371	.49634	24370	.17898
	24322	.23646	24334	.42445	24374	.33909
51	21831	.12421	21940	.41853	21947	.45726
	21858	.20300	21905	.38145	21995	.41555
52	21831	.28274	21940	.51066	21947	.20660
	21858	.28560	21905	.48470	21995	.22970
53	21419	.46092	21487	.31740	21552	.22168
	21428	.52159	21454	.29396	21589	.18445
54	52212	.35029	52297	.29966	52387	.35005
	52261	.41680	52297	.22020	52352	.36300

N	Numbers of stars and dependences					
55	52212	.34888	52297	.33283	52387	.31829
	52261	.42222	52297	.26509	52352	.31269
56	25529	.37581	25535	.37869	25595	.24550
	25495	.23256	25553	.38693	25582	.38051
57	25537	.42369	25379	.23827	25400	.33804
	25354	.29536	25359	.30073	25405	.40391
58	25537	.46801	25379	.22752	25400	.30447
	25354	.29420	25359	.33654	25405	.36926
59	25043	.32401	25053	.29591	25078	.38008
	25010	.36452	25053	.29759	25102	.33789
60	25043	.36712	25053	.28155	25078	.35133
	25010	.38448	25053	.29259	25102	.32293
61	24926	.20112	24966	.30771	24980	.49117
	24932	.20771	24953	.35196	24990	.44033
62	24926	.22541	24966	.31607	24980	.45852
	24932	.24145	24953	.33999	24990	.41856
63	24592	.22472	24638	.37037	24688	.40491
	24575	.08695	24636	.37197	24667	.54108
64	24592	.29214	24638	.35792	24688	.34994
	24575	.13327	24636	.39597	24667	.47076
65	22141	.32126	22193	.15597	22215	.52277
	22137	.32547	22168	.25981	22234	.41472
66	22141	.36984	22193	.19998	22215	.43018
	22137	.40073	22168	.21258	22234	.38669
67	21800	.33069	21801	.26856	21912	.40075
	21793	.42241	21830	.19468	21912	.38291
68	21800	.29084	21801	.38649	21912	.32267
	21793	.40390	21830	.31748	21912	.27862
69	97676	.33263	97689	.43176	97745	.23561
	97659	.21662	97711	.33890	97715	.44448
70	97676	.34402	97689	.42916	97745	.22682
	97659	.22910	97711	.33620	97715	.43470
71	97676	.46536	97689	.40029	97745	.13435
	97659	.36008	97711	.30858	97715	.33134
72	97634	.27808	97648	.28834	97709	.43358
	97578	.20748	97674	.29770	97697	.49482
73	97634	.27950	97648	.29091	97709	.42959
	97578	.21031	97674	.29587	97697	.49382

N	Numbers of stars and dependences					
74	97634	.32563	97648	.37194	97709	.30243
	97578	.30004	97674	.24245	97697	.45751
75	97610	.35155	97648	.37002	97709	.27843
	97578	.28246	97634	.26489	97697	.45265
76	97610	.35264	97648	.37186	97709	.27550
	97578	.28573	97634	.26284	97697	.45143
77	97582	.14254	97648	.38977	97659	.46769
	97578	.31525	97659	.30199	97676	.38276
78	97582	.18750	97613	.32670	97659	.48580
	97557	.26777	97617	.22593	97667	.50630
79	97582	.30940	97613	.37785	97659	.31275
	97557	.37998	97617	.22646	97667	.39356
80	97582	.31525	97613	.38027	97659	.30448
	97557	.38521	97617	.22653	97667	.38826
81	97385	.35496	79845	.25683	97484	.38821
	97403	.35956	79840	.30101	97480	.33943
82	97385	.37538	79845	.25535	97484	.36927
	97403	.38580	79840	.29868	97480	.31552
83	79764	.27828	97416	.49240	79845	.22932
	79770	.33006	97370	.34279	97479	.32715
84	79764	.29288	97416	.48321	79845	.22391
	79770	.34192	97370	.34012	97479	.31796
85	79764	.41679	97416	.40167	79845	.18154
	79770	.44677	97370	.31011	97479	.24312
86	79764	.42863	97416	.39412	79845	.17725
	79770	.45670	97370	.30752	97479	.23578
87	97275	.34307	79789	.40587	97370	.25106
	79743	.41005	97343	.37828	79809	.21167
88	79665	.28658	79758	.32162	97385	.39180
	79639	.23150	79760	.31784	79372	.45066
89	79665	.38185	79758	.35398	97385	.26417
	79639	.30939	79760	.37733	79372	.31328
90	79661	.33108	79686	.28288	79707	.38604
	79627	.21241	79695	.50103	79705	.28656
91	79681	.32378	79695	.44706	79742	.22916
	79667	.16678	79705	.48861	79710	.34461
92	79681	.32071	79695	.44419	79742	.23510
	79667	.16013	79705	.49383	79710	.34604

N	Numbers of stars and dependences					
93	79698	.36903	79736	.33875	79760	.29222
	79701	.48953	79732	.19728	79767	.31319
94	79698	.36291	79736	.34051	79760	.29658
	79701	.48656	79732	.19344	79767	.32000
95	79700	.33242	79738	.33578	79794	.33180
	79661	.24097	79750	.27476	79782	.48427
96	79700	.28558	79736	.38066	79794	.33376
	79689	.34230	79750	.20309	79782	.45461
97	79700	.21042	79736	.35573	79794	.43385
	79689	.22649	79750	.26245	79782	.51106
98	80512	.44500	98297	.32554	80604	.22946
	98259	.51385	80563	.36460	98321	.12155
99	80512	.47601	98297	.21610	80605	.30789
	98212	.34027	80563	.27956	98321	.38017
100	145483	.23163	164532	.38684	145541	.38153
	145483	.38084	145524	.27629	164565	.34287
101	145484	.25605	164537	.35389	145541	.39006
	145483	.36785	145524	.27877	164565	.35338
102	146198	.49223	146225	.26386	165242	.24391
	146178	.42227	165217	.21268	146269	.36505
103	146220	.31155	146281	.25896	146306	.42949
	146225	.37373	146296	.40935	146323	.21692
104	146220	.29235	146281	.26782	146306	.43983
	146225	.36099	146296	.40354	146323	.23547
105	146279	.34335	146340	.30640	146350	.35025
	146267	.21614	146333	.50011	146350	.28375
106	146279	.33208	146340	.31287	146350	.35505
	146267	.20640	146333	.50226	146350	.29134
107	146703	.30150	146714	.20501	146726	.49349
	146701	.20924	146707	.27483	146734	.51593
108	146703	.27441	146714	.19303	146726	.53256
	146701	.18464	146707	.27634	146734	.53902
109	129031	.46062	129110	.30055	129135	.23883
	129035	.47926	129110	.31707	129139	.20367
110	129031	.45104	129110	.30350	129135	.24546
	129035	.47028	129110	.31811	129139	.21161
111	129382	.36650	129418	.19738	129432	.43612
	129394	.15810	129404	.59842	129440	.24348

5. List of collaborators

Name	Exposures	Measurements	Reductions
G. Červák	58	58	–
P. Rychtarčík	53	53	–
J. Svoreň	–	–	111

Acknowledgements. This work was supported, in part, by the Slovak Grant Agency for Science (grant VEGA No. 1023).

References

Murray, C.A.: 1989, *Astron. Astrophys.* **218**, 325

Svoreň, J.: 2001, *Contrib. Astron. Obs. Skalnaté Pleso* **31**, 149

Smithsonian Astrophysical Observatory Star Catalog. Parts 1-3, Washington, Smithsonian Institution, 1966

Yeomans, D.K.: 1990, *Conversion to FK5/J2000.0*, IAU Commission 20, The letter dated 5 December 1990