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Astrometry of minor planets made at the Skalnaté Pleso Observatory in 2010

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Abstract. The paper presents results of position determinations of minor planets carried out at the Skalnaté Pleso Observatory in 2010. A total of 110 accurate positions of 26 minor planets are given.
Key words: asteroids – astrometry

1. Introduction

The present paper is a continuation of our previous papers which gave the results of positional CCD observations of minor planets obtained at the Skalnaté Pleso Observatory (the last paper of this series being Husárik, 2012) and contains observations made in 2010. Missing observations from 2005 to 2009 will be published one after the other simultaneously with the new obtained positions.

The observations were performed with a 0.61-m f/4.3 reflector and a CCD camera SBIG ST-10XME. We obtained CCD frames using a Johnson-Cousins R filter with 3×3 binning and resolution of 1.6 arcsec/px. We applied the standard calibration with dark and flatfield frames with IRAF tools. The positions of minor planets were made using the method of plate constants within the software *Astrometrica* (Raab, 2011). The reference stars were selected from UCAC-3 star catalogue.

A total of 110 accurate positions of 26 minor planets are given, as well as a list of collaborators.

2. Positions of minor planets

Table 1 presents the results of positional CCD observations. The data have been arranged according to serial numbers of minor planets.

Table 1. The individual columns of the table contain the following information: N – ordinal number of the 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 °, ′, ″), dα – the mean residual in R.A. (in s), dδ – the mean residual in Decl. (in ″), Magn. – magnitude of the minor planet in the R filter, dmag – the mean residual in magnitude (in mag), Ref. st. – number of reference stars with a known position and/or magnitude that are used to find the plate constants and photometric calibration of an image.

N	Date U.T.		$R.A._{2000}$ dα	$Decl._{2000}$ dδ	Magn. dmag	Ref. st.
			(596) Scheila			
1	2010 Dec.	14.91124	09 59 01.84	+28 25 04.3	13.6	33
			0.01	0.1	0.1	
2	2010 Dec.	15.19042	09 59 04.98	+28 26 42.5	13.6	31
			0.01	0.1	0.1	
3	2010 Dec.	15.97245	09 59 14.09	+28 31 18.5	13.5	30
			0.01	0.1	0.2	
4	2010 Dec.	16.20152	09 59 16.30	+28 32 40.7	13.5	23
			0.01	0.1	0.2	
5	2010 Dec.	16.95271	09 59 24.00	+28 37 11.7	13.5	25
			0.01	0.1	0.2	
6	2010 Dec.	17.16683	09 59 25.78	+28 38 30.4	13.4	18
			0.01	0.1	0.1	
7	2010 Dec.	27.86287	09 59 37.98	+29 50 45.1	13.2	14
			0.01	0.2	0.2	
8	2010 Dec.	28.02122	09 59 36.75	+29 51 56.0	13.3	16
			0.01	0.1	0.2	
			(1095) Tulipa			
9	2010 Mar.	09.95970	13 26 08.75	−05 37 05.1	14.7	30
			0.01	0.1	0.1	
10	2010 Mar.	10.06619	13 26 06.15	−05 36 25.8	14.5	28
			0.02	0.1	0.2	
11	2010 Mar.	23.91815	13 19 03.28	−04 01 22.1	14.4	41
			0.01	0.2	0.2	
12	2010 Mar.	24.10184	13 18 56.32	−04 00 00.2	14.1	37
			0.01	0.2	0.2	
13	2010 Apr.	03.89876	13 11 47.14	−02 38 01.8	14.1	26
			0.02	0.2	0.1	
14	2010 Apr.	03.78962	13 11 44.39	−02 37 32.5	14.0	24
			0.01	0.2	0.2	
15	2010 Apr.	17.84425	13 02 04.17	−00 55 53.5	14.2	27
			0.01	0.1	0.1	
16	2010 Apr.	18.07319	13 01 54.75	−00 54 20.1	14.2	29
			0.01	0.1	0.1	

N	Date U.T.		$R.A._{2000}$ dα	$Decl._{2000}$ dδ	Magn. dmag	Ref. st.
			(2121) Sevastopol			
17	2010 Aug.	07.88964	00 36 38.30 0.01	+01 31 14.6 0.1	14.6 0.2	26
18	2010 Aug.	07.97066	00 36 40.10 0.01	+01 31 05.0 0.1	14.6 0.2	25
19	2010 Aug.	21.96543	00 38 37.46 0.01	+00 38 16.9 0.1	14.2 0.2	25
20	2010 Aug.	22.09853	00 38 36.24 0.01	+00 37 32.8 0.1	14.3 0.2	24
21	2010 Oct.	12.80313	00 03 46.21 0.01	−06 02 18.3 0.1	14.1 0.1	36
22	2010 Oct.	12.99122	00 03 38.51 0.01	−06 03 13.9 0.1	14.1 0.2	29
			(2257) Kaarina			
23	2010 Oct.	30.00439	04 38 55.28 0.01	+21 57 03.0 0.2	15.8 0.2	104
24	2010 Oct.	30.12684	04 38 51.14 0.02	+21 56 29.8 0.2	15.8 0.2	93
25	2010 Nov.	15.79190	04 25 52.71 0.01	+20 29 55.7 0.2	15.6 0.2	57
26	2010 Nov.	15.96494	04 25 42.34 0.01	+20 28 57.1 0.1	15.5 0.2	56
27	2010 Nov.	28.00649	04 13 27.80 0.02	+19 18 23.2 0.1	13.7 0.3	32
28	2010 Nov.	28.10499	04 53 48.83 0.03	+19 17 48.2 0.2	13.7 0.3	36
29	2010 Nov.	30.94384	04 10 29.93 0.01	+19 01 28.9 0.2	13.6 0.2	36
30	2010 Dec.	01.08493	04 10 21.22 0.01	+19 00 39.9 0.3	13.7 0.2	34
			(3657) Ermolova			
31	2010 Dec.	04.93047	04 53 54.20 0.01	+19 42 52.4 0.1	14.9 0.2	92
32	2010 Dec.	05.00767	04 53 48.83 0.01	+19 42 30.8 0.1	15.0 0.2	99
33	2010 Dec.	07.74634	04 50 44.57 0.02	+19 29 49.7 0.3	15.0 0.2	84
34	2010 Dec.	07.81822	04 50 39.63 0.01	+19 29 30.7 0.2	15.1 0.2	94
			(3868) Mendoza			
35	2010 Sep.	07.88671	01 38 40.55 0.01	+06 15 05.8 0.4	15.1 0.2	21
36	2010 Sep.	07.93463	01 38 40.12 0.01	+06 14 45.4 0.4	15.1 0.2	22

N	Date U.T.		$R.A._{2000}$ dα	$Decl._{2000}$ dδ	Magn. dmag	Ref. st.
37	2010 Sep.	19.88230	01 34 59.02	+04 35 37.7	15.0	27
			0.01	0.1	0.1	
38	2010 Sep.	20.11679	01 34 51.78	+04 33 26.3	14.9	22
			0.01	0.1	0.1	
39	2010 Sep.	20.82630	01 34 31.19	+04 26 45.5	14.9	19
			0.01	0.1	0.1	
40	2010 Sep.	20.97005	01 34 26.61	+04 25 24.2	14.8	18
			0.01	0.1	0.1	
41	2010 Oct.	27.74205	01 07 13.04	−01 25 50.4	14.8	24
			0.01	0.1	0.1	
42	2010 Oct.	27.91242	01 07 05.76	−01 27 02.5	14.8	22
			0.01	0.1	0.1	
43	2010 Oct.	29.75579	01 05 52.90	−01 39 34.4	15.1	20
			0.01	0.1	0.1	
44	2010 Oct.	29.91551	01 05 46.45	−01 40 37.1	15.1	14
			0.01	0.1	0.1	
			(5325) Silver			
45	2010 Jun.	05.95443	20 46 58.62	+01 45 14.6	15.0	62
			0.01	0.1	0.2	
46	2010 Jun.	06.04124	20 47 00.79	+01 44 53.2	14.9	54
			0.01	0.1	0.2	
47	2010 Jun.	07.94730	20 47 48.07	+01 36 25.4	14.8	56
			0.01	0.1	0.1	
48	2010 Jun.	08.03990	20 47 50.04	+01 35 58.9	14.9	51
			0.01	0.1	0.1	
49	2010 Jun.	09.96034	20 48 30.32	+01 26 06.1	14.8	68
			0.01	0.2	0.1	
50	2010 Jun.	10.04714	20 48 31.83	+01 25 37.2	15.0	63
			0.02	0.2	0.1	
51	2010 Jun.	13.98819	20 49 31.23	+01 00 56.3	14.6	69
			0.01	0.2	0.2	
52	2010 Jun.	13.92454	20 49 30.61	+01 01 23.0	14.7	65
			0.01	0.2	0.2	
53	2010 Jul.	09.98256	20 43 30.99	-04 24 13.3	14.3	61
			0.01	0.2	0.1	
54	2010 Jul.	10.04911	04 50 39.63	-04 25 25.2	14.3	60
			0.01	0.1	0.1	
			(4949) Akasofu = 1988 WE			
55	2010 Jan.	20.09404	08 52 40.74	+20 04 58.2	15.7	48
			0.01	0.2	0.2	
56	2010 Jan.	20.13744	08 52 37.91	+20 05 15.9	15.9	48
			0.01	0.2	0.1	
			(6300) Hosamu			
57	2010 Aug.	07.88964	00 36 46.80	+01 31 16.8	17.7	26
			0.05	0.7	0.2	

N	Date U.T.		$R.A._{2000}$ $d\alpha$	$Decl._{2000}$ $d\delta$	Magn. dmag	Ref. st.
58	2010 Aug.	08.07194	00 36 45.86 0.02	+01 31 06.2 0.3	18.5 0.2	25
			(8373) Stephengould			
59	2010 Jan.	24.80227	11 25 31.81 0.02	+76 36 28.2 0.3	15.6 0.3	23
60	2010 Jan.	24.99365	11 26 46.54 0.01	+76 42 57.1 0.1	15.8 0.1	27
			(9448) Donaldavies			
61	2010 Apr.	03.78962	13 11 40.56 0.02	−02 42 10.2 0.3	17.6 0.1	26
62	2010 Apr.	03.96265	13 11 32.03 0.02	−02 41 08.4 0.3	17.3 0.2	24
			(10452) Zuev			
63	2010 Jul.	21.90032	23 33 52.30 0.01	+05 00 23.9 0.2	14.7 0.8	26
64	2010 Jul.	22.05079	23 33 58.16 0.01	+05 01 07.1 0.1	14.7 0.7	24
65	2010 Jul.	23.02009	23 34 36.56 0.01	+05 05 36.3 0.2	14.6 0.6	16
66	2010 Jul.	23.06801	23 34 38.31 0.01	+05 05 49.4 0.1	14.8 0.7	15
67	2010 Aug.	11.86328	23 41 19.82 0.01	+05 40 37.3 0.1	15.0 0.2	23
68	2010 Aug.	12.06582	23 41 19.49 0.01	+05 40 25.3 0.1	14.9 0.1	20
69	2010 Oct.	03.76428	23 16 01.54 0.01	−01 06 32.7 0.1	14.8 0.1	37
70	2010 Oct.	03.82215	23 16 00.10 0.01	−01 07 04.1 0.2	14.9 0.2	35
71	2010 Oct.	06.78818	23 15 01.29 0.01	−01 33 00.7 0.1	14.8 0.2	21
72	2010 Oct.	07.00230	23 14 57.08 0.01	−01 34 48.9 0.1	14.9 0.2	16
73	2010 Oct.	07.72545	23 14 46.02 0.01	−01 40 49.5 0.1	14.8 0.2	22
74	2010 Oct.	08.00323	23 14 41.07 0.01	−01 43 06.1 0.1	15.0 0.2	16
75	2010 Oct.	09.73225	23 14 18.45 0.01	−01 56 52.8 0.2	15.1 0.2	27
76	2010 Oct.	09.99557	23 14 14.75 0.01	−01 58 54.9 0.2	15.1 0.2	21
			(14316) Higashichichibu			
77	2010 Dec.	16.95271	09 59 47.70 0.02	+28 41 29.0 0.3	17.4 0.2	25

N	Date U.T.	$R.A._{2000}$ dα	$Decl._{2000}$ dδ	Magn. dmag	Ref. st.
78	2010 Dec. 17.16683	09 59 48.52	+28 41 53.2	17.4	18
		0.01	0.1	0.1	
		(15350) Naganuma			
79	2010 Jan. 19.94258	08 42 13.23	+09 49 46.6	15.9	21
		0.01	0.1	0.2	
80	2010 Jan. 20.00913	08 42 08.88	+09 50 05.5	15.8	19
		0.01	0.1	0.2	
81	2010 Jan. 21.89953	08 40 08.60	+09 59 17.4	15.9	37
		0.01	0.1	0.2	
82	2010 Jan. 22.03552	08 39 59.66	+09 59 58.0	16.0	37
		0.01	0.1	0.2	
		(15700) 1987 QD			
83	2010 Oct. 11.77617	22 50 30.67	−12 29 17.1	16.2	29
		0.01	0.2	0.1	
84	2010 Oct. 11.92524	22 50 34.17	−12 32 24.7	16.4	24
		0.01	0.1	0.1	
		(21950) 1999 VS158			
85	2010 Dec. 07.74634	04 50 24.66	+19 25 01.7	16.1	84
		0.03	0.4	0.2	
86	2010 Dec. 07.81822	04 50 21.64	+19 24 48.6	17.1	94
		0.03	0.4	0.2	
		(47853) 2000 EA144			
87	2010 Jun. 13.92454	20 50 10.17	+01 03 10.2	16.4	69
		0.01	0.2	0.2	
88	2010 Jun. 14.00556	20 50 11.00	+01 03 59.3	16.6	65
		0.01	0.2	0.2	
		(56390) 2000 EH91			
89	2010 Jan. 19.94258	08 42 21.38	+09 50 46.2	18.0	21
		0.01	0.2	0.2	
90	2010 Jan. 20.00913	08 42 17.24	+09 50 58.5	17.8	19
		0.02	0.3	0.2	
91	2010 Jan. 21.89953	08 40 21.47	+09 56 50.6	16.9	37
		0.01	0.2	0.2	
92	2010 Jan. 22.03552	08 40 12.73	+09 57 16.8	17.8	37
		0.01	0.2	0.2	
		(68905) 2002 JZ104			
93	2010 Sep. 07.88671	01 38 32.22	+06 17 28.3	15.1	21
		0.01	0.4	0.2	
94	2010 Sep. 07.98255	01 38 31.18	+06 16 59.2	17.7	22
		0.01	0.4	0.2	
		(87151) 2000 NZ18			
95	2010 Oct. 12.80313	00 04 10.80	−05 58 09.9	18.2	36
		0.03	0.5	0.1	

N	Date U.T.		$R.A._{2000}$ dα	$Decl._{2000}$ dδ	Magn. dmag	Ref. st.
96	2010 Oct.	12.99122	00 04 03.51	−05 58 49.4	18.1	29
			0.02	0.3	0.2	
			(88604) 2001 QH293			
97	2010 Oct.	11.97308	00 21 58.56	+22 38 38.5	16.9	31
			0.01	0.1	0.1	
98	2010 Oct.	12.12748	00 21 50.30	+22 37 40.9	17.1	33
			0.01	0.2	0.1	
			(110207) 2001 SO210			
99	2010 Nov.	30.94384	04 10 13.46	+19 01 07.7	16.8	36
			0.03	0.5	0.2	
100	2010 Dec.	01.08493	04 10 04.73	+19 00 45.4	16.7	34
			0.05	0.8	0.2	
			(172566) 2003 UH165			
101	2010 Aug.	11.86328	23 41 34.17	+05 41 42.2	18.0	23
			0.04	0.5	0.2	
102	2010 Aug.	12.06582	23 41 31.56	+05 41 27.8	18.0	20
			0.02	0.3	0.1	
			(178505) 1999 TO148			
103	2010 Oct.	06.91839	23 15 17.35	−01 30 12.9	18.5	21
			0.03	0.3	0.2	
104	2010 Oct.	07.00230	23 15 14.05	−01 30 33.1	18.5	16
			0.03	0.4	0.2	
			(189099) 2001 RO			
105	2010 Jan.	15.94134	08 42 48.70	+02 46 38.7	15.1	31
			0.01	0.1	0.2	
106	2010 Jan.	16.09691	08 42 34.16	+02 43 25.2	15.1	27
			0.01	0.1	0.2	
107	2010 Jan.	26.99449	08 25 42.09	−00 41 22.5	15.0	56
			0.01	0.1	0.2	
108	2010 Jan.	27.04657	08 25 37.17	−00 42 14.5	15.3	54
			0.02	0.2	0.2	
			2003 AG2			
109	2010 Jan.	19.94258	08 42 47.29	+09 49 50.5	17.6	21
			0.02	0.1	0.2	
110	2010 Jan.	20.00913	08 42 40.65	+09 48 59.6	16.7	19
			0.01	0.1	0.2	

3. List of collaborators

Table 2. A list of people who participated in the observations and the position measurements and reductions.

Name	Exposures	Measurements	Reductions
G. Červák	27	–	–
M. Husárik	1	110	110
Z. Krišandová	2	–	–
M. Pikler	24	–	–
D. Tomko	1	–	–

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