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Observations of comets and minor planets at Kiev comets station (585)

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Abstract. We present the results of astrometric and photometric observations of comets and minor planets obtained at the Kiev comet station (Code MPC 585) of the Astronomical Observatory of Kyiv Shevchenko National University in 2006-2009. The 2318 position observations of 176 comets, 302 observations of 57 numbered minor planets, and 220 observations of 30 unnumbered minor planets were obtained. The accuracy of the astrometric observations of the comets is analyzed.

Keywords. Astrometry, ephemeris, comets: general, minor planets

1. Introduction

CCD astrometric monitoring of new and short period comets and new asteroids is very important for the determination and improvement of their orbits and the study of the orbital evolution of new small bodies of the Solar System (Steel & Marsden, 1996). In 2006 a programme was started at observation station of the Astronomical observatory of the Kiev National University in Lisnyky ("Kiev Comet Station, code MPC 585 performing astrometric and photometric observations of comets and minor planets of Solar System. Observations are obtained according to the technique of the Minor Planet Center (MPC) (Holmes, 1995) with of the telescope reflector AZT-8 (D = 0.7 m), and CCD ST-8E which is accomodated in the primary focus of the telescope (focus of system $F = 2.8$ m, focal ratio $f/4$). The above noted equipment gives the chance to detect in integrated light the images of asteroids to a brightness of 21^m, and comets to 19.5^m.

2. The program of monitoring

The programme of monitoring minor Solar System bodies is directed to the objectives: 1) Observations of just discovered objects for the purpose of confirming their actually existence and receiving first astrometric and photometric observations. The list of objects which require confirmation is daily renewed by the Minor Planet Centre internet page – The NEO Confirmation Page. 2) Astrometric observations of known long- and short-period comets for the purpose of determining changes in the orbital characteristics which are connected to non-gravitational and gravitational perturbations. 3) Photometric observations of comets (integral and nucleus comet magnitude, size of the coma, degree of a central condensation of in the coma, length and position angle of the tail).

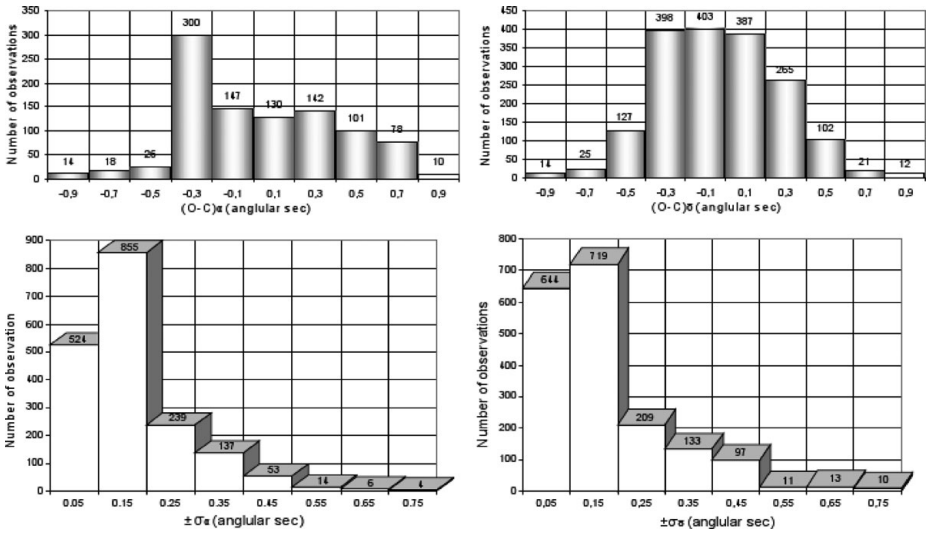

Figure 1. Distributions of the residuals $(O-C)_\alpha \ \pm\sigma_\alpha$ & $(O-C)_\delta \ \pm\alpha_\delta$.

4) Observations of unique comets during rare outbursts, split comets, appearance of peculiar tails. For example, we obtained a long series of observations of the unique comet 73P/Schwassmann-Wachmann, which nucleus had split into a considerable quantity of fragments (we identified 16 separate fragments of the comet). 5) Astrometric and photometric observations of asteroids which approach to the Earth (NEOs) and asteroids of the Main Belt.

3. Result and analyses of observations

The astrometric observations of comets and their accuracy are shown in the table 4

Figure (Fig. 1) shows diagrams of the accuray distribution of the observed (O-C) in angular sec for Right Accession $(O-C)_\alpha \ \pm\sigma_\alpha$ and for Declination $(O-C)_\delta \ \pm\sigma_\delta$. It is seen, that the basic quantity of observations is received with an accuracy of 0 - 0.4" for $(O-C)_\alpha$ and $(O-C)_\delta$. The diagram $(O-C)_\alpha$ is a little asymmetric, which is probably connected with restriction of accuracy of the telescopes clock mechanism. On the diagrams for $\pm\sigma_\alpha$ and $\pm\sigma_\delta$ the error of the majority of observations does not exceed 0,2".

4. Conclusion

Between 2.04.2006 - 9.05.2009 (140 nights) a total of 2318 observations were obtained of 176 comets, and 522 observations of 87 asteroids. The maximum quantity of observations has been obtained with an accuracy from 0,1" to 0,2". Results of astrometric and photometric observations were contributed to the database of the Minor Planet Centre (MPC), the International Comet Quarterly (ICQ), and to the database of the British Astronomical Association (BAA).

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Table 1. Accuracy of astrometric observations of comets. Column 1: comet name, column 2: period of observations, column 3: number of observations, column 4: residual (O-C) for R.A., column 5: (O-C) for Declination.

Comets	**Period observ.**	**N**	$(O-C)_\alpha \pm \sigma_\alpha$	$(O-C)_\delta \pm \sigma_\delta$
4P/Faye	2006	30	0.22 ± 0.11	0.03 ± 0.09
6P/dÁrrest	2008	17	0.10 ± 0.17	-0.04 ± 0.15
8P/Tuttle	2008	8	-0.14 ± 0.22	0.12 ± 0.26
17P/Holmes	2007 – 2008	39	0.31 ± 0.11	0.29 ± 0.08
19P/Borrelly	2008 – 2009	4	-0.67 ± 0.11	0.50 ± 0.22
22P/Kopff	2009	18	-0.67 ± 0.19	-0.19 ± 0.16
29P/Schwassmann-Wachmann	2006, 2008 – 2009	33	0.15 ± 0.16	-0.07 ± 0.18
41P/Tuttle-Giacobini-Kresak	2006	2	0.30 ± 1.20	0.05 ± 0.65
44P/Reinmuth	2007 – 2008	10	0.20 ± 0.23	0.25 ± 0.20
46P/Wirtanen	2007 – 2009	16	-0.20 ± 0.21	-0.11 ± 0.25
50P/Arend	2007 – 2008	14	-0.08 ± 0.18	-0.15 ± 0.07
51P/Harrington	2008	7	-0.23 ± 0.28	0.24 ± 0.14
59P/Kearns-Kwee	2008	10	-0.21 ± 0.16	-0.45 ± 0.13
65P/Gunn	2008	4	0.11 ± 0.08	-0.71 ± 0.14
67P/Churyumov-Gerasimenko	2009	9	0.49 ± 0.26	0.19 ± 0.10
68P/Klemola	2008	4	0.35 ± 0.77	-0.05 ± 0.53
74P/Smirnova-Chernykh	2007 – 2009	23	-0.04 ± 0.16	0.19 ± 0.09
77P/Longmore	2009	23	-0.05 ± 0.11	-0.21 ± 0.13
79P/du Toit-Hartley	2008	3	0.17 ± 0.18	-0.77 ± 0.37
84P/Giclas	2006	9	-0.33 ± 0.20	-0.84 ± 0.30
87P/Bus	2007	3	0.77 ± 0.35	0.43 ± 0.64
88P/Howell	2009	5	0.52 ± 0.07	0.05 ± 0.23
98P/Takamizawa	2006	3	0.73 ± 0.18	0.17 ± 0.52
110P/Hartley	2007 – 2008	3	-0.33 ± 0.18	0.30 ± 0.36
112P/Urata-Niijima	2006	11	-0.20 ± 0.26	-0.44 ± 0.29
114P/Wiseman-Skiff	2006	3	-0.20 ± 0.87	0.33 ± 0.62
116P/Wild	2008 – 2009	8	0.15 ± 0.19	0.10 ± 0.18
124P/Mrkos	2008	10	-0.480 ± 0.06	0.02 ± 0.14
128P/Shoemaker-Holt	2006 – 2008	2	0.10 ± 0.50	0.15 ± 0.25
143P/Kowal-Mrkos	2009	10	-0.18 ± 0.09	-0.03 ± 0.15
144P/Kushida	2008 – 2009	13	0.64 ± 0.29	0.02 ± 0.16
173P/Mueller	2008	5	0.75 ± 0.35	-0.10 ± 0.19
177P/Barnard	2006	50	-0.32 ± 0.06	-0.41 ± 0.10
179P/Jedicke	2007 – 2008	11	0.27 ± 0.44	-0.28 ± 0.18
180P/NEAT	2008	10	-0.22 ± 0.23	0.08 ± 0.26
182P/LONEOS	2007	4	-0.07 ± 0.44	0.15 ± 0.72
183P/Korlevic-Juric	2008	7	-0.65 ± 0.13	-0.62 ± 0.03
188P/LINEAR-Mueller	2008	7	-0.30 ± 0.48	0.10 ± 0.23
189P/NEAT = P/2007 N2	2007	3	0.00 ± 0.40	-0.17 ± 0.87
191P/McNaught = P/2007 N1	2007	11	-0.21 ± 0.42	-0.47 ± 0.21
192P/Shoemaker-Levy	2008	5	0.20 ± 0.31	-0.79 ± 0.26
194P/LINEAR	2008	3	0.18 ± 0.05	0.07 ± 0.20
197P/LINEAR	2008	6	0.36 ± 0.40	0.14 ± 0.41
200P/Larsen	2008	5	-0.03 ± 0.39	0.25 ± 0.14
202P/Scotti	2008	5	-0.25 ± 0.54	-0.33 ± 0.08
205P/Giacobini	2008	28	-0.94 ± 0.13	-0.34 ± 0.07
206P/ Barnard-Boattini = P/2008T3	2008	16	-0.31 ± 0.17	0.01 ± 0.14
210P/Christensen	2009	10	-0.23 ± 0.11	-0.27 ± 0.07
C/2002 VQ94 (LINEAR)	2006, 2008	4	0.22 ± 0.36	-0.16 ± 0.35
C/2003 WT42 (LINEAR)	2006 – 2007	13	-0.19 ± 0.17	0.10 ± 0.17
C/2004 B1 (LINEAR)	2006	45	-0.01 ± 0.09	0.44 ± 0.49
P/2004 VR 8 (LONEOS)	2006	3	0.18 ± 0.22	1.02 ± 0.13
P/2005 JY 126 (Catalina)	2006	4	0.53 ± 0.10	0.15 ± 0.23
C/2005 L3 (McNaught)	2007 – 2008	60	0.38 ± 0.07	0.40 ± 0.09
C/2005 S4 (McNaught)	2006 – 2008	10	-0.09 ± 0.17	0.47 ± 0.36

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Comets	**Period observ.**	**N**	$(O-C)_\alpha \pm \sigma_\alpha$	$(O-C)_\delta \pm \sigma_\delta$
P/2005 SB 216 (LONEOS)	2006	5	-0.24 ± 0.20	0.29 ± 0.14
C/2006 CK10 (Catalina)	2006	5	0.46 ± 0.20	-0.4 ± 0.80
P/2006 F1 (Kowalski)	2006	7	0.88 ± 0.26	-0.00 ± 0.31
P/2006 H1 (McNaught)	2006	8	0.64 ± 0.30	0.73 ± 0.17
P/2006 HR 30 (Siding Spring)	2006 – 2007	21	0.06 ± 0.19	-0.14 ± 0.10
P/2006 K2 (McNaught)	2006	3	0.89 ± 0.35	0.06 ± 0.90
C/2006 K4 (NEAT)	2006	4	0.43 ± 0.35	-0.44 ± 0.44
C/2006 M1 (LINEAR)	2006	9	0.02 ± 0.14	-0.07 ± 0.21
C/2006 M4 (SWAN)	2006	4	-0.43 ± 0.27	-0.35 ± 0.11
C/2006 O2 (Garradd)	2006	5	-0.20 ± 0.31	-0.23 ± 0.50
P/2006 R2 (Christensen)	2006	6	0.10 ± 0.41	-0.64 ± 0.37
C/2006 OF2 (Broughton)	2007 – 2009	72	-0.32 ± 0.05	-0.22 ± 0.04
C/2006 Q1 (McNaught)	2009	11	-0.68 ± 0.24	0.53 ± 0.06
P/2006 S1 (Christensen)	2006	13	-0.18 ± 0.21	0.48 ± 0.39
C/2006 S2 (LINEAR)	2006	8	-0.55 ± 0.15	0.69 ± 0.24
C/2006 S3 (LONEOS)	2006	3	0.88 ± 0.90	0.02 ± 0.28
P/2006 S4 (Christensen)	2006	14	0.38 ± 0.27	-0.10 ± 0.33
C/2006 S5 (Hill)	2006, 2008	34	0.39 ± 0.13	-0.10 ± 0.08
P/2006 S6 (Hill)	2006	19	0.28 ± 0.12	0.29 ± 0.11
C/2006 V1 (Catalina)	2007	4	0.33 ± 0.34	0.22 ± 0.24
C/2006 VZ13 (LINEAR)	2007	8	0.54 ± 0.30	0.09 ± 0.36
C/2006 W3 (Christensen)	2008 – 2009	83	0.62 ± 0.04	1.38 ± 0.05
P/2006 U1 (LINEAR)	2006	9	0.60 ± 0.25	-0.14 ± 0.12
P/2006 U5 (Christensen)	2006	3	-0.17 ± 0.05	0.05 ± 0.14
C/2007 B2 (Skiff)	2007 – 2008	29	-0.24 ± 0.09	-0.20 ± 0.09
C/2007 D1 (LINEAR)	2007	7	0.22 ± 0.10	0.02 ± 0.15
C/2007 E1 (Garradd)	2007	35	0.48 ± 0.13	-0.14 ± 0.13
C/2007 E2 (Lovejoy)	2007	64	0.46 ± 0.14	-0.28 ± 0.14
C/2007 F1 (LONEOS)	2007	6	0.05 ± 0.32	-0.27 ± 0.36
C/2007 G1 (LINEAR)	2007 – 2008	15	0.15 ± 0.18	0.12 ± 0.10
P/2007 H1 (McNaught)	2007	10	0.15 ± 0.17	0.06 ± 0.19
C/2007 M1 (McNaught)	2007	10	-0.51 ± 0.29	-0.21 ± 0.34
C/2007 JA21	2007	4	0.12 ± 0.54	0.14 ± 0.59
C/2007 M3 (LINEAR)	2007	27	-0.40 ± 0.17	0.02 ± 0.07
C/2007 N3 (Lulin)	2007 – 2009	44	0.01 ± 0.11	0.32 ± 0.07
C/2007 O1 (LINEAR)	2007	5	-0.05 ± 0.18	-0.26 ± 0.42
P/2007 Q2 (Gilmore)	2007	9	-0.41 ± 0.34	-0.31 ± 0.32
P/2007 R1 (Larson)	2007	8	-0.02 ± 0.34	-0.05 ± 0.44
P/2007 R2 (Gibbs)	2007	10	0.34 ± 0.22	-0.22 ± 0.29
P/2007 S1 (Zhao)	2007	5	1.37 ± 0.33	-1.15 ± 0.49
C/2007 S2 (Lemmon)	2007	9	0.33 ± 0.17	-0.19 ± 0.39
C/2007 T1 (McNaught)	2007	5	-0.50 ± 0.20	0.62 ± 0.23
P/2007 T2 (Kowalski)	2007	11	0.60 ± 0.22	0.59 ± 0.21
C/2007 T5 (Gibbs)	2007 – 2008	19	-0.28 ± 0.37	-0.41 ± 0.45
P/2007 T6 (Catalina)	2007	9	-0.34 ± 0.32	-0.42 ± 0.19
C/2007 U1 (LINEAR)	2008	10	0.12 ± 0.16	0.30 ± 0.14
P/2007 V1 (Larson)	2007 – 2008	9	0.37 ± 0.32	0.31 ± 0.33
C/2007 W1 (Boattini)	2007 – 2008	30	-0.30 ± 0.13	-0.37 ± 0.15
C/2007 W3 (LINEAR)	2008	15	0.65 ± 0.32	-0.23 ± 0.36
C/2007 Y1 (LINEAR)	2008	28	-0.28 ± 0.18	0.29 ± 0.19
P/2008 A2 (LINEAR)	2008	18	-0.30 ± 0.23	-0.18 ± 0.22
C/2008 C1 (Chen-Gao)	2008	46	-0.23 ± 0.12	-0.31 ± 0.12
C/2008 E1 (Catalina)	2008	6	0.94 ± 0.15	-0.28 ± 0.27
C/2008 FK75 (Lemmon-Siding Spring)	2009	5	0.04 ± 0.09	$1.01 \pm .096$
C/2008 G1 (Gibbs)	2008	5	0.12 ± 0.09	0.56 ± 0.22
C/2008 H1 (LINEAR)	2008	16	-0.15 ± 0.24	0.40 ± 0.21
C/2008 J1 (Boattini)	2008	33	-0.14 ± 0.07	-0.00 ± 0.13
P/2008 J2 (Beshore)	2008	27	$+0.57 \pm 0.10$	$+0.19 \pm 0.13$

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Comets	**Period observ.**	**N**	$(O-C)_\alpha \quad \pm\sigma_\alpha$	$(O-C)_\delta \quad \pm\sigma_\delta$
C/2008 J5 (Garradd)	2008	5	-0.48 ± 0.51	0.20 ± 0.28
C/2008 J6 (Hill)	2008	22	0.30 ± 0.17	-0.18 ± 0.20
P/2008 L2 (Hill)	2008	13	0.12 ± 0.07	-0.02 ± 0.07
C/2008 L3 (Hill)	2008	4	1.31 ± 0.06	0.83 ± 0.20
C/2008 N1 (Holmes)	2008	9	-0.10 ± 0.14	0.18 ± 0.12
P/2008 O2 (McNaught)	2008	20	0.411 ± 0.17	0.11 ± 0.17
C/2008 Q1 (Maticic)	2008 – 2009	37	-0.29 ± 0.10	0.11 ± 0.11
P/2008 Q2 (Ory)	2008	15	0.41 ± 0.07	-0.03 ± 0.04
P/2008 QP20 (LINEAR-Hill)	2008	8	-0.37 ± 0.15	-0.57 ± 0.17
C/2008 R3 (LINEAR)	2008	6	0.41 ± 0.18	-0.19 ± 0.14

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