

Kyiv UkrVO glass archives: new life

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The core of the UkrVO is the Joint Digital Archive (JDA) of photographic observations.

JDA: 41 000 plates, obtained with 32 instruments from 5 observatories; plate scales: from 20 to 412 "/mm; exposing time: from 1 sec to 1.5 h.

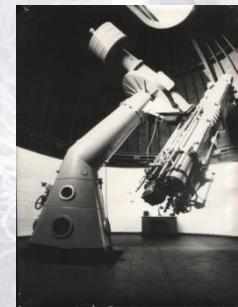
<http://194.44.35.19/vo-mao/DB/archivespecial.php>



**Zeiss Double Wide-Angle Astrograph (DWA); Main Astron. Obs., Kyiv, Ukraine; D=400mm, F=2000mm;
Period of operation: 1976-2005; Plate scale 103.13 "/mm;
Field of view: 8x8°; B < 17mag;
Archives: GUA040C, GUA040D.**



**Tepfer Double Long-Focus Astrograph (DLA); Main Astron. Obs., Kyiv, Ukraine; D=400mm, F=5500mm;
Period of operation: 1949-1986;
Plate scale 37.48 "/mm; Field of view: 2.5x2.5°; B < 14mag;
Archives: GUA040A, GUA040B.**



**Double Astrograph Merts-Repsold (AMR); Astronomical Observatory, Kyiv Shevchenko National University; D=200mm, F=4260mm;
Period of operation: 1946-1996 ; Plate scale 48 "/mm; Field of view: 1.7x1.7°; B < 14mag; Archive: KAO020A**



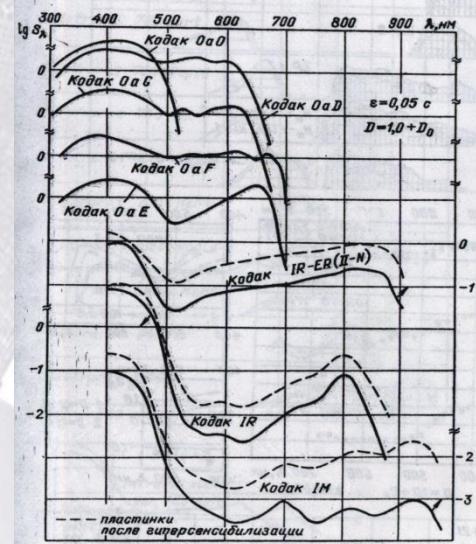
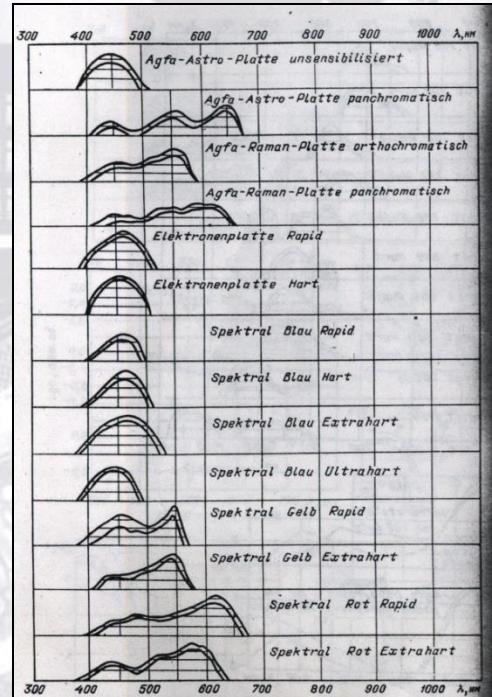
**Azimuth mirror telescope AZT-8 (AZT8); Astronomical Observatory, Kyiv Shevchenko National University, Lisnyky; D=700mm, F=2800mm;
Period of operation: 1970-1990 ; Plate scale 90.7 "/mm; Field of view: 0.2x0.2°; B < 17mag; Archive: KAO070A.**



JDA: LIST OF EMULSIONS

<http://194.44.35.19/vo-mao/DB/guides.php>

Designation	Name	Manufacturer
Agfa Astro	Agfa Astro-plates (Unsens)	Fabrication Alemana. Germany
AgfaPanchro	Agfa Astro Panchrîm sensibili	Fabrication Alemana. Germany
IlforZenith	Ilford Zenith Plates, sup. sensitiv	Ilford Limited. London
IlfoSpecRap	Ilford Spectral Rapid	Ilford Limited. London
Kodak, OaE	Kodak Plates, OaE	Kodak Limited. London
Kodak, OaO	Kodak Plates, OaO	Kodak Limited. London
KodakU103aO	Kodak USA. Plates, 103aO	Eastman Kodak. New York
KodakUSpect	Kodak USA. Plates, Eastm.Spectr.	Eastman Kodak. New York
ORWO ZU21	ORWO ZU21 Astro Plates, Unsens	Veb filmfabrik Wolfen. DDR
ORWO NP27	ORWO NP27 Panchromatic	Veb filmfabrik Wolfen. DDR
U2 Panchrom	USSR N2, Panhrom	Fabrication N2. USSR
U2 Unsens	USSR N2, Unsens	Fabrication N2. USSR
U5FilmPanch	USSR N5, Film Panchromatic	Fabrication N5. USSR
UFilmInfraP	USSR, Film Infra Panchrom	USSR, Shostka. Ukraine
UFilmlsop17	USSR, Film Isopanchrom, type 17	USSR, Shostka. Ukraine
UN Unsens	USSR Nikfi, Unsens	Nikfi. Moscow
UNInfrachro	USSR Nikfi, Infrachrom	Nikfi. Moscow
UZTFDiaposi	USSR ZTF, for science, diapos.	ZTF. Moscow



Astrometric solutions with JDA

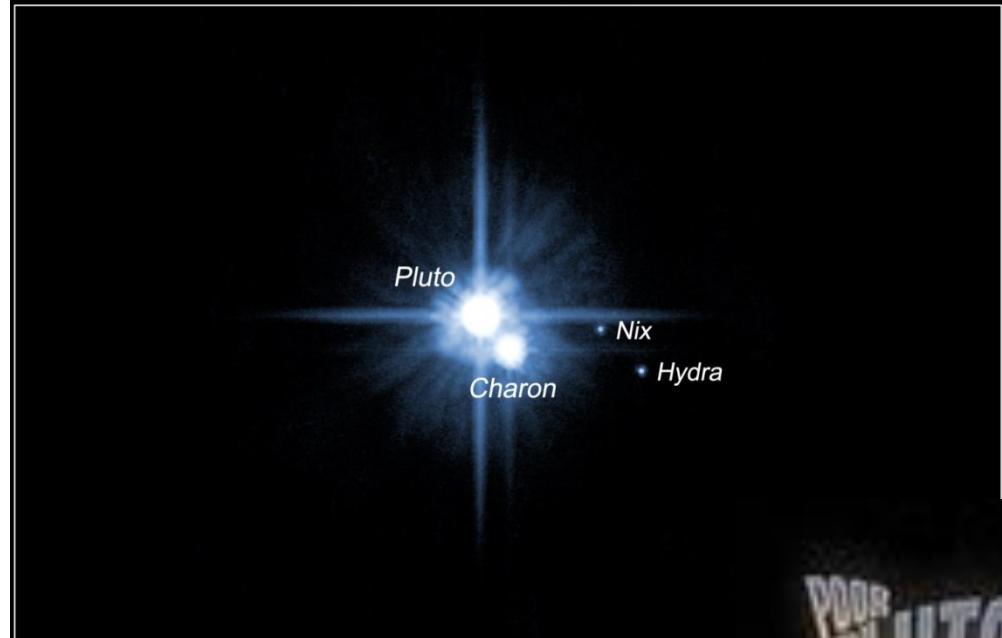
Items under discussion:

- Catalogues of Pluto positional data.
- Astrometric solutions for Jupiter and Saturn satellites.
- The positional accuracy of minor planets determinations.
- Search of optical analogs of GRB and creation of catalogs of objects in the areas around GRBs.

Database basic software is a LINUX-MIDAS-ROMAFOT.

Pluto System ▪ February 15, 2006

Hubble Space Telescope ▪ ACS/HRC



NASA, ESA, H. Weaver (JHU/APL), A. Stern (SwRI),
and the HST Pluto Companion Search Team

Pluto system

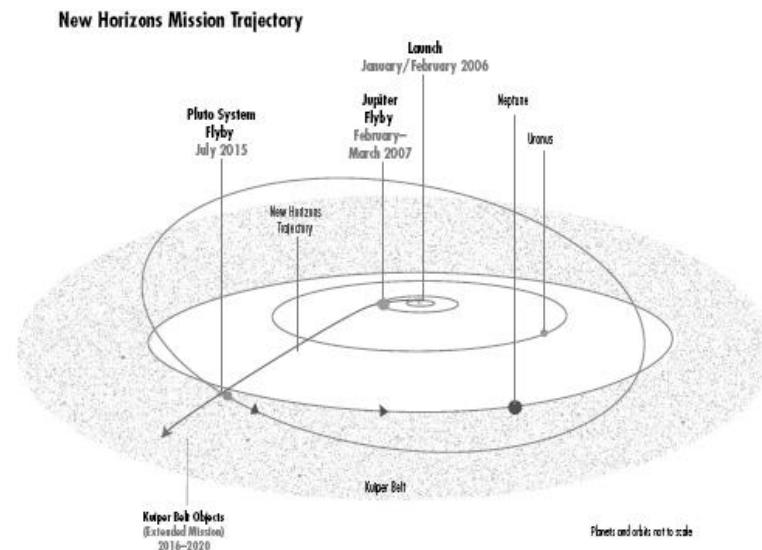


Results of astrometric processing of scanned images of Pluto on photographic plates

Now we notice the increasing interest to the exact positions of Pluto on the eve of the Pluto mission



A NASA New Frontiers Mission



http://194.44.35.19/va-mao/DB/data_search.php

DATABASE of GOLOSIIV PLATE ARCHIVE (DBGPA V2.0)

OUTPUT PREFERENCES SEARCH PLATES: FIELD OVERLAP OBJECTS BY ID# OR NUMBERS GUIDES SPECIALS V1.1

принтер | сканер | журналы наблюдений

You've inquired:
RA = 13° m ° DEC = 35° °
Area round dimensions radius = 4 deg.of.arc
In the archive: everyone
Dates: *
Exposition: every color: every
Search plates all

[Back to OVERLAP Form with the same parameters](#)

Images	GUA ID	RA hhmmss	DEC ddmmss	Date mmddyy	Expos. min.	Dimensions cm.	Instrum.	Place of
	GUA040A002655	12 39 29	+34 13 55	6004	X 586	Y: 549		
	GUA040A002651	12 39 30	+34 13 53	6003	7	16 38 49		
	GUA040A002650	12 39 30	+34 13 53	6003				
	GUA040A001983	12 39 35	+34 13 16	6104				
	GUA040A004417	12 47 19	+30 23 37	6003				
	GUA040C001429	12 47 25	+32 08 38	8902				
	GUA040C002795	12 47 42	+36 13 38	9304				
	GUA040C001225A	12 47 42	+36 10 38	8804				
			+36 04 38	9304				
	GUA040C002202			+39 09 22	8209			
Scans available on e-mail demand:								
grey 16 bit 1200 dpi TIFF/FITS 400Mb								
grey 16 bit 1200 dpi								
(90 CW rotated) TIFF/FITS 400Mb								
<Click to close>								
	GUA040C000701A	12 55 12	+31 18 39	9510				
	GUA040C000265A	12 55 12	+30 58 39	9510				
	GUA040C000246B	12 55 12	+30 58 39	9510				

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MAO NASU



26 positions

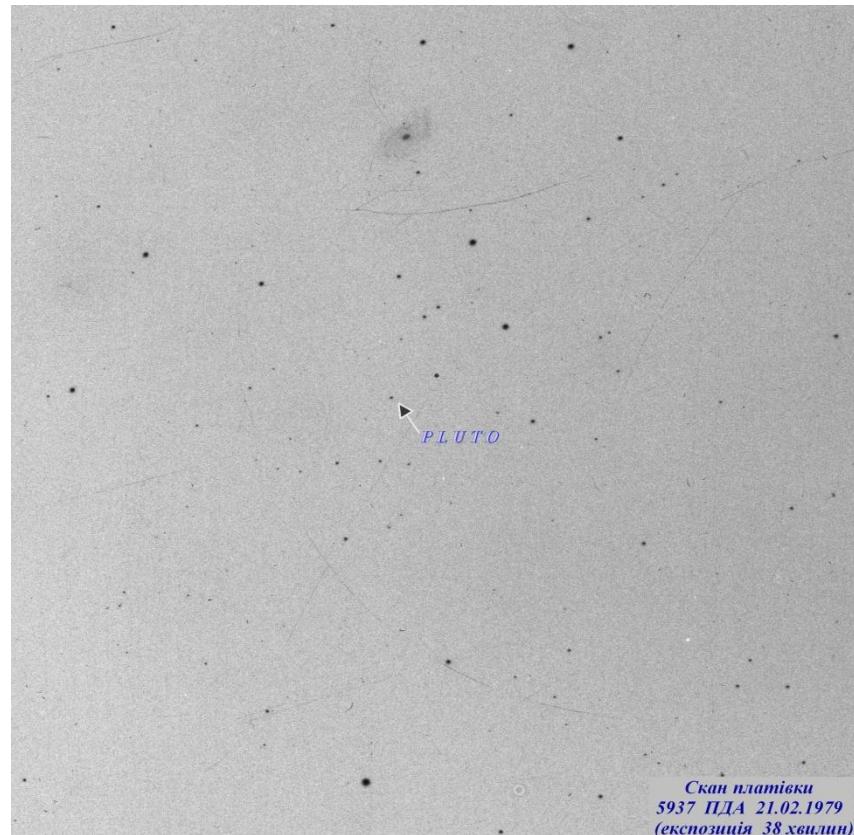
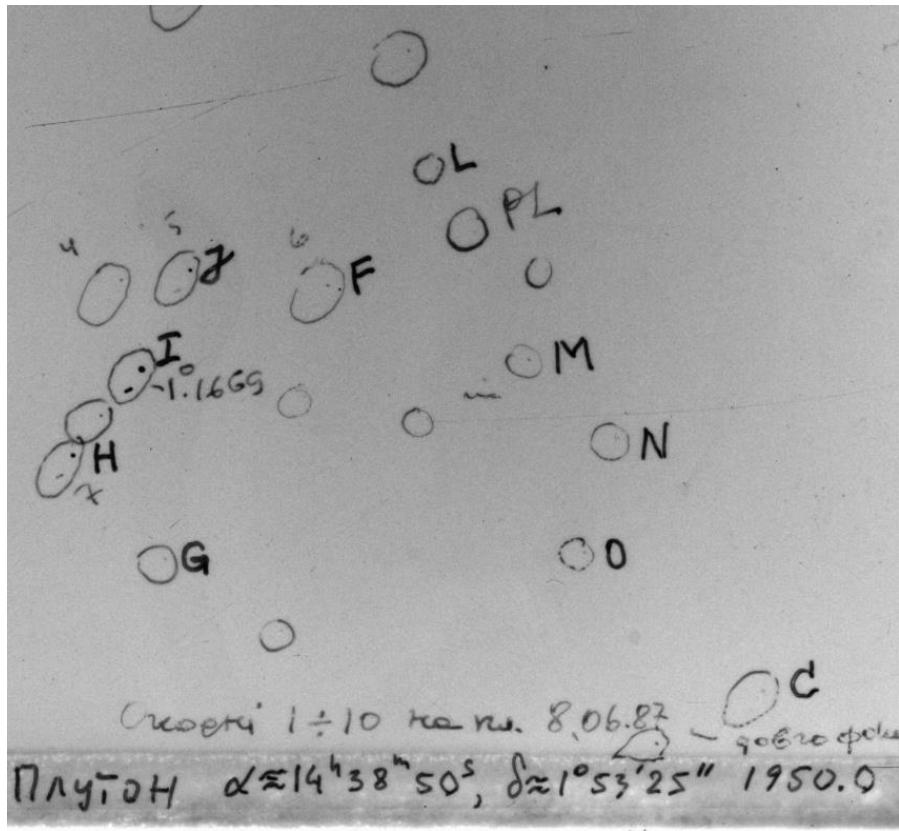


41 positions

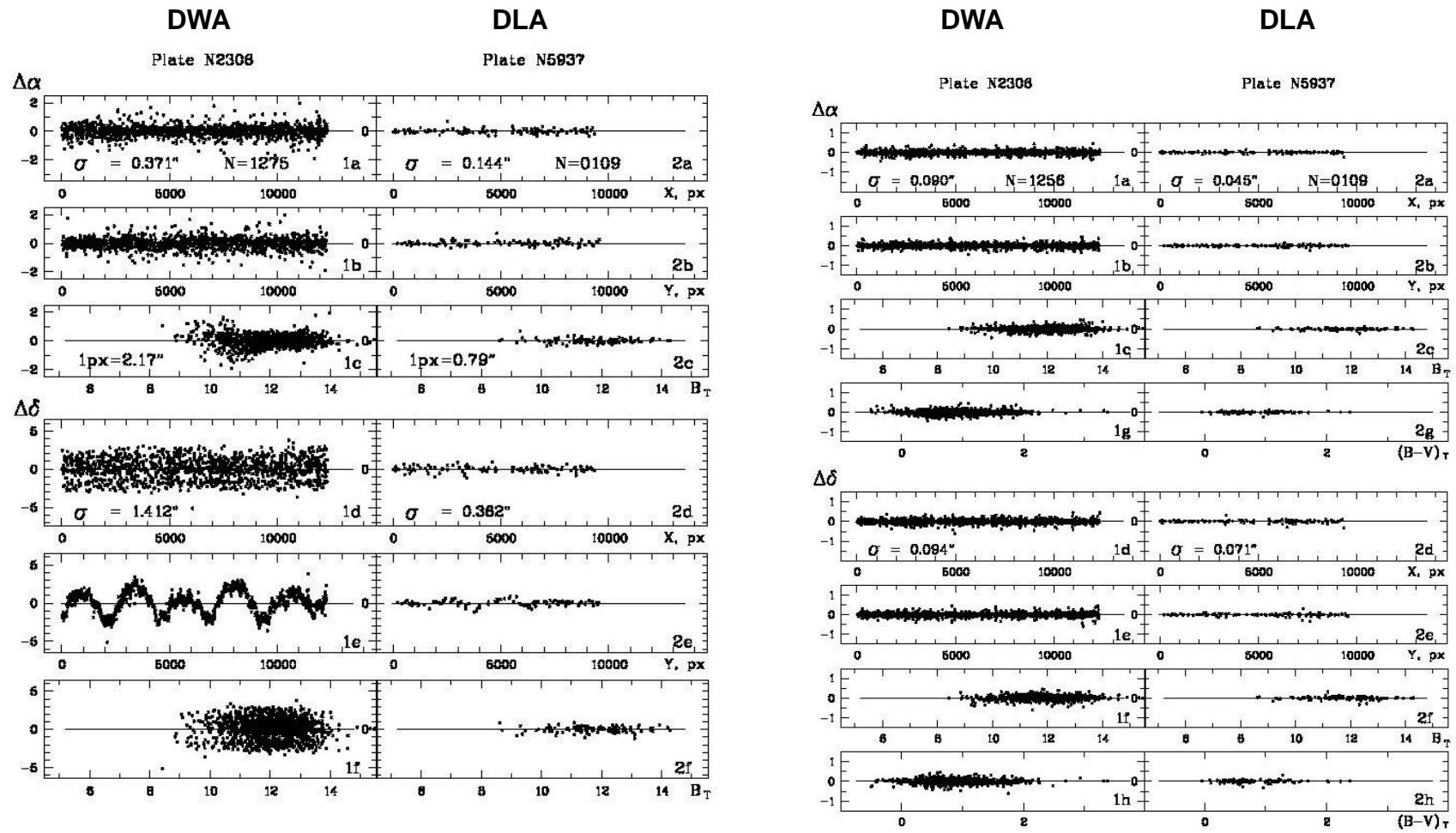
JDA contains 67 digital images of plates with Pluto in archives of 2 observatories related to 1961-1990.

Meta-data of used plates from archives of MAO NASU and AO KNU

Archives	N	Instrument F/D	Period	Size plate sm	Scale images "/mm	scale scan. "/px
GUA040A	3	DLA 5500/400	1961-1979	24x24	38	0.79
GUA040C	23	DWA 2000/400	1979-1989	30x30	103	2.17
GUA040D						
KAO020A	31	AMR 4260/200	1986-1990	16x16	48	1.06
KAO070A	10	AZT8 2800/700	1987	13x13	91	2.14



Left image - the preview of KAO070A272004 plate with Pluto. Right image – the high level resolution plate GUA040A005937 (1200 dpi) with Pluto.

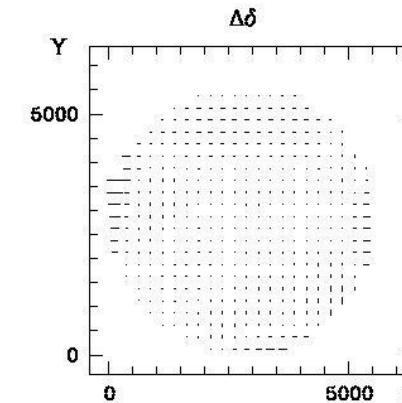
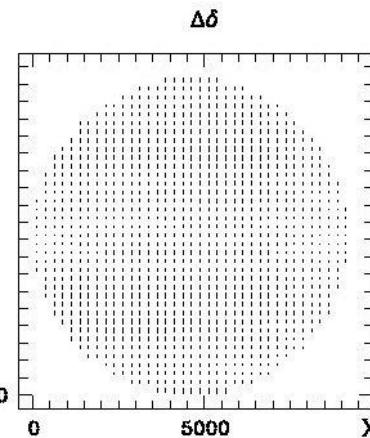
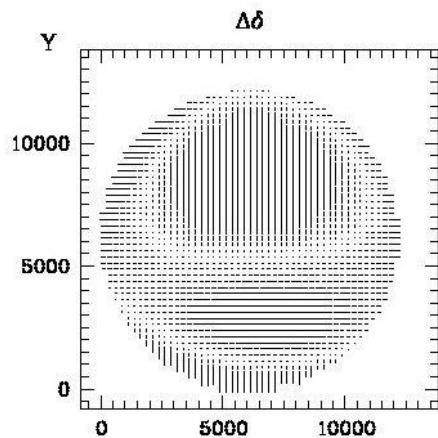
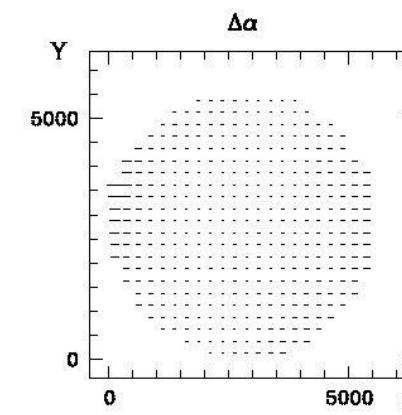
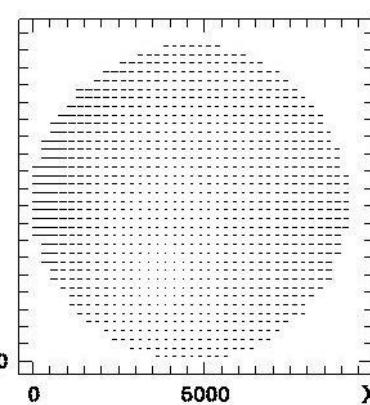
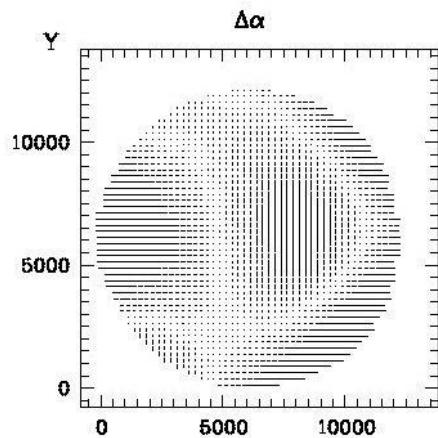


The trend of systematic differences between measured values and catalog coordinates of stars before (left) and after the correction (right) for the instrumental errors of the scanner for two plates of different instruments.
 (LINUX-MIDAS-ROMAFOT software).

Plate N2308

Plate 5937

Plate N14/0257



The distribution of the resulted errors over the field of the plate not only characterizes the optics but indirectly shows the quality of plate processing and scanner systematics accounting (Pl.2308 - DWA; Pl.5937 - DLA; Pl.n14/257 – AMR). (LINUX-MIDAS-ROMAFOT software).

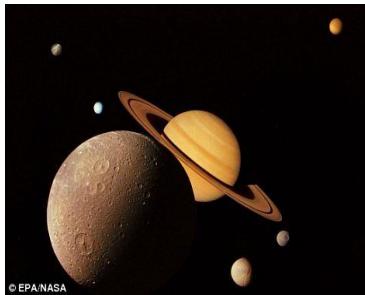
The results obtained in digital images processing with Tycho-2 as reference (left) and in the classic procedure of plate adjustment with ACT and AGK-3 as reference (right).

Tycho-2					ACT		
Instrument	Number of plates	Number of reference stars	σ_α , arcsec	σ_δ , arcsec	σ_α , arcsec	σ_δ , arcsec	Number of plates
DLA	2	108	0.06	0.11	0.20	0.24	1
DWA	23	1062	0.11	0.12	0.32	0.32	21
AZT8	24	62	0.15	0.14	0.60	0.40	11
AMR	2	8	0.28	0.26	-	-	2

The final catalog of Pluto photographic positions contains 60 records. The publication with the detailed analysis is in preparation.



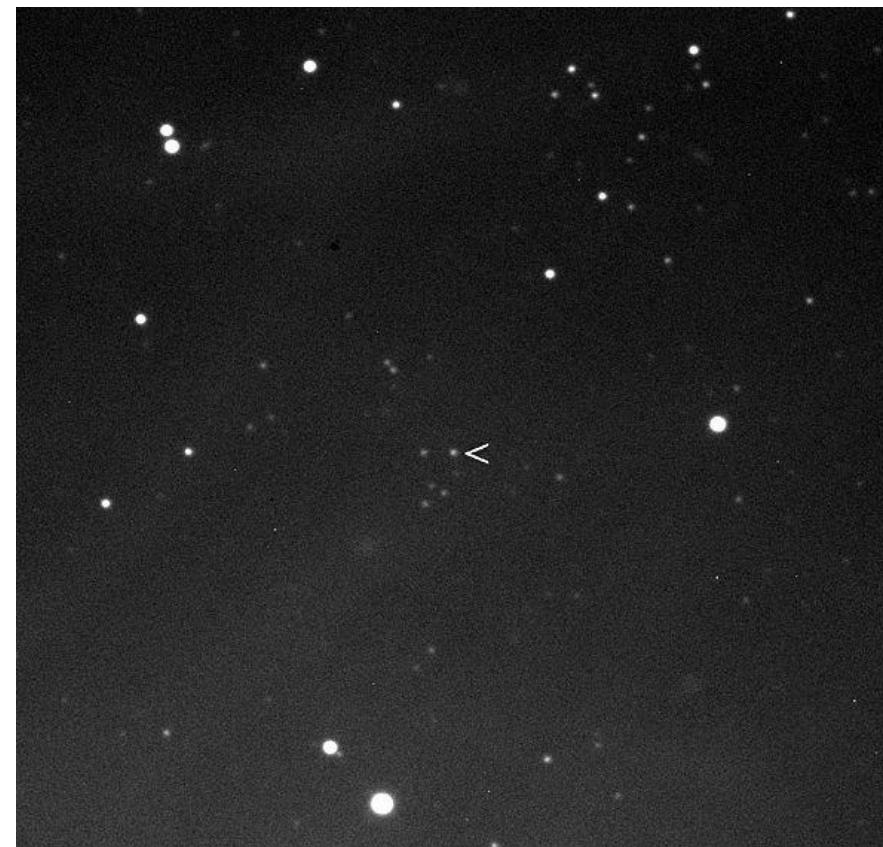
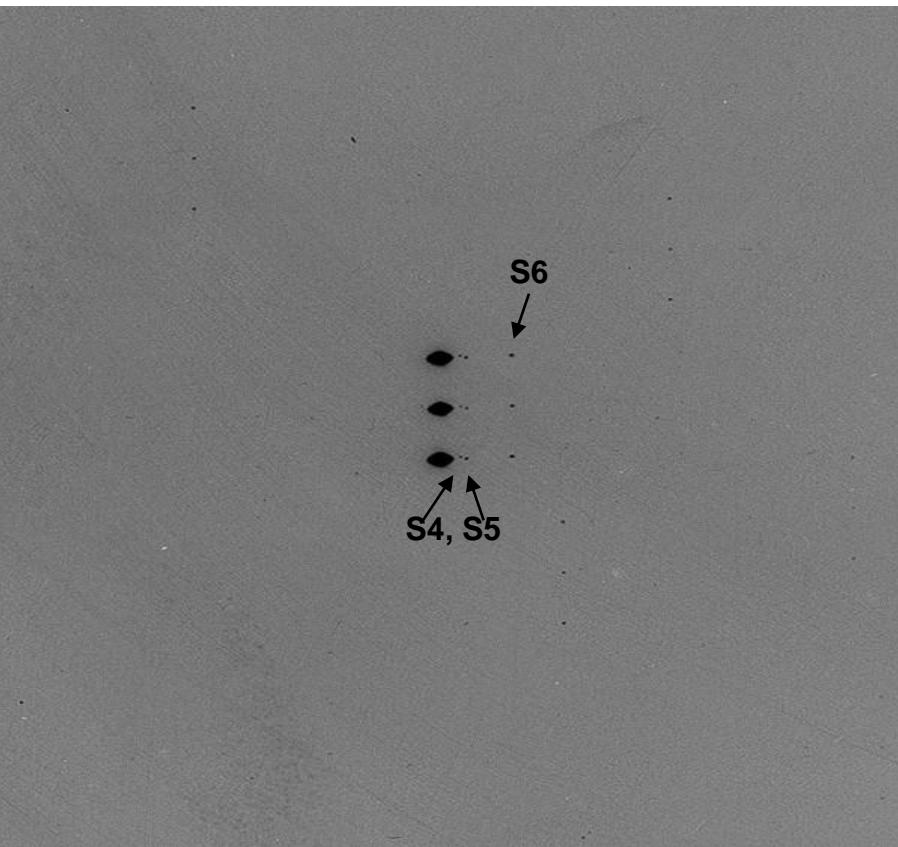
Astrometric solutions for Jupiter and Saturn satellites



Dione S4 10.4 mag
Rhea S5 9.7 mag
Titan S6 8.4 mag



Elara J8
17 mag



The main goals of their treatment were determining

-whether the better positional accuracy could be achieved with those photographic material due to new methodic of image processing

and

- could the scanned images in general be used for the astrometric solutions with the high positional accuracy in applications for moving objects.

Observational statistics

4 instruments in 4 observational sites

Instruments	Archives	Time span	Planet	Number of plates	of these digitized
DWA (MAO,Kyiv)	GUA040C GUA040D	1976-1996	Jupiter	36	35
		1976-1988	Saturn	53	14
DWA (Kitab)	TAS040A TAS040B	1988	Jupiter	2	2
		1986	Saturn	8	7
Zeiss-600 (Majdanak)	MAJ060	1987-1991	Jupiter	31	19
		1989-1991	Saturn	54	3
DLA (MAO,Kyiv)	GUA0040A GUA0040B	1963-1979	Jupiter	4	1
		1961-1984	Saturn	134	83

The comparison of obtained positions with the ephemerides in IMCCE

Name	B <i>mg</i>	Number of plates	(O-C) $_{\alpha}$, arcsec	(O-C) $_{\delta}$, arcsec	RMS $_{\alpha}$, arcsec	RMS $_{\delta}$, arcsec
DLA (Kyiv)						
Dione S4	10.4	28	-0.12"	-0.07"	0.36"	0.26"
Rhea S5	9.7	40	0.02	-0.03	0.31	0.27
Titan S6	8.4	35	-0.01	-0.12	0.29	0.29
Japetus S8	10.2-11.9	40	0.06	0.03	0.28	0.33
DWA (Kyiv)						
Himalia J6	~14.8	5	0.11	-0.26	0.54	0.35
Zeiss-600 (Majdanak)						
Himalia J6	~14.8	6	0.22	0.09	0.36	0.53
Elara J7	~17.1	2	1.42	-0.24	1.45	0.86
DWA (Kitab)						
Himalia J6	~14.8	2	0.48	0.23	0.52	0.24

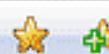
The positional accuracy of minor planets determinations

We used the 4179 Toutatis asteroids ephemerides which were taken from the Minor Planet Center for time scale 1976-1996
(<http://cfa-www.harvard.edu/iau/mpc.html>).

Ephemerides 4179 Toutatis in the moments of the closest approaches (M) with the Earth's orbit.

Date Y M D	R.A.(J2000)DEC h m s deg ' "	M AU	V Mag
19890104	032906 +170837	0.14	13.0
19921214	095556 +050046	0.04	11.0
19930114	080413 +195414	0.26	13.2

The next step of our work was the looking for asteroids on the plates of JDA using these ephemerides.



DATABASE OF ASTRONOMICAL GLASS PLATE ARCHIVE OF MAO NAS OF UKRAINE (DBGPA V2.0)

OUTPUT SETTINGS

SEARCH
PLATES:

FIELD OVERLAP

OBJECTS

BY IDs OR
NUMBERS

GUIDES

SPECIALS

DBGPA
V1.0

правки

Plate: unique ID: 15746 WFPDB-type ID: GUA040C002088 original log-number: 002088 archive ID: GUA040C

RA: 8 h 15 m 50 s DEC: + 16 d 9 m 45 s date: 930114 UT: 224223

number of exp.: 2 first exposition: 1 min

object Northern sky survey object type: field method: direct photograph, multiexposure

emulsion: ORWO ZU21 filter: None spectrum: Pg

dimensions: 30 X 30 cm observers: G.A.Ivanov

telescope: Double Wide Angle Astrograph (MAO)

availability: Available at the Main Astron.Obs., Kyiv, Ukraine; shelf 317 box 17

notes: Orig.No.FON-2088; Hour angle +0:07; Tube position "E"; T=+03 deg C; Pressure 748; 2nd Tstart=224423, hour angle +0:19, duration 22.5, limit magnitude 15

quality: High background intensity; Inhomogeneity of background density

AUXILIARY DATA

log-number suffix:

CCOD:

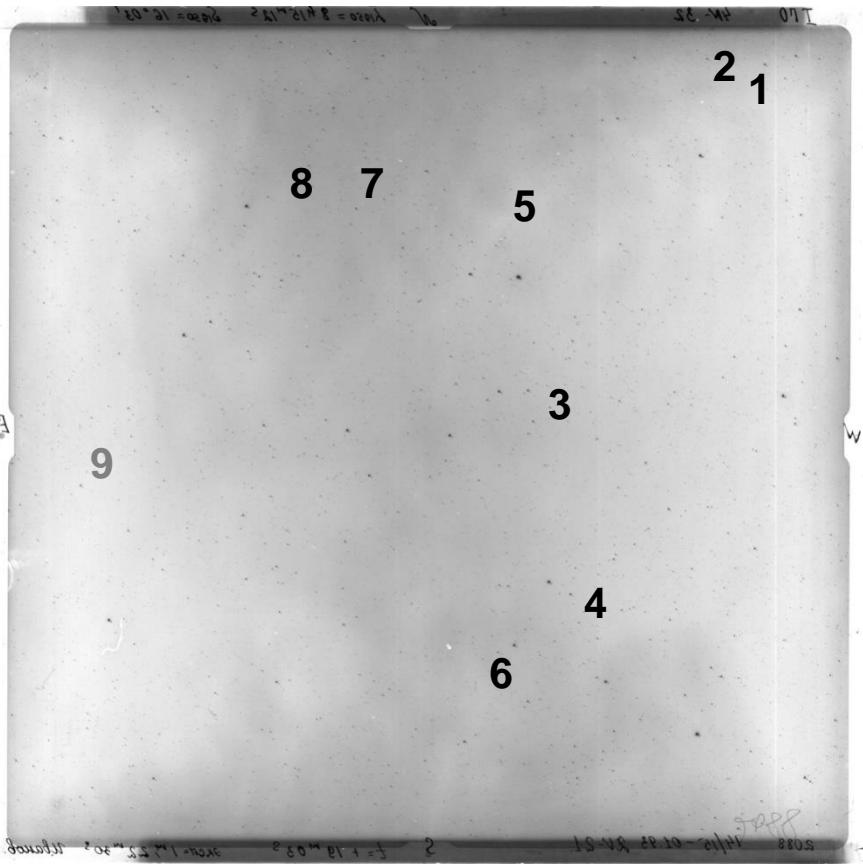
TCOD:

pointers: 11110

cross-ID: 0

GUA040C002088 plate with the marks of possible images of nine asteroids.

Center of the plate: **08h15m50s+16d09'45"**; Date 1993 Jan 14; UT=22h55m38s (the moments of middle of the second exposure, duration of exposure 22m.5.



Name	Ephemerides from the Minor Planet Center
1 (2854) Rawson	08h02m18.7s +19°40'22"
2 (4179) Toutatis	08 03 15.5 +19 59 30
3 (1401) Lavonne	08 08 27.8 +15 45 37
4 (232) Russia	08 10 44.6 +14 12 11
5 (1689) Floris- Jan	08 12 24.3 +18 56 10
6 (1249) Rutherfordia	08 13 18.0 +13 50 39
7 (1457) Ankara	08 16 12.2 +19 18 47
8 (21023) 1989 DK	08 19 51.0 +19 17 04
9 (807) Ceraskia	08 30 33.6 +15 42 12

Images of two asteroids among the stars.

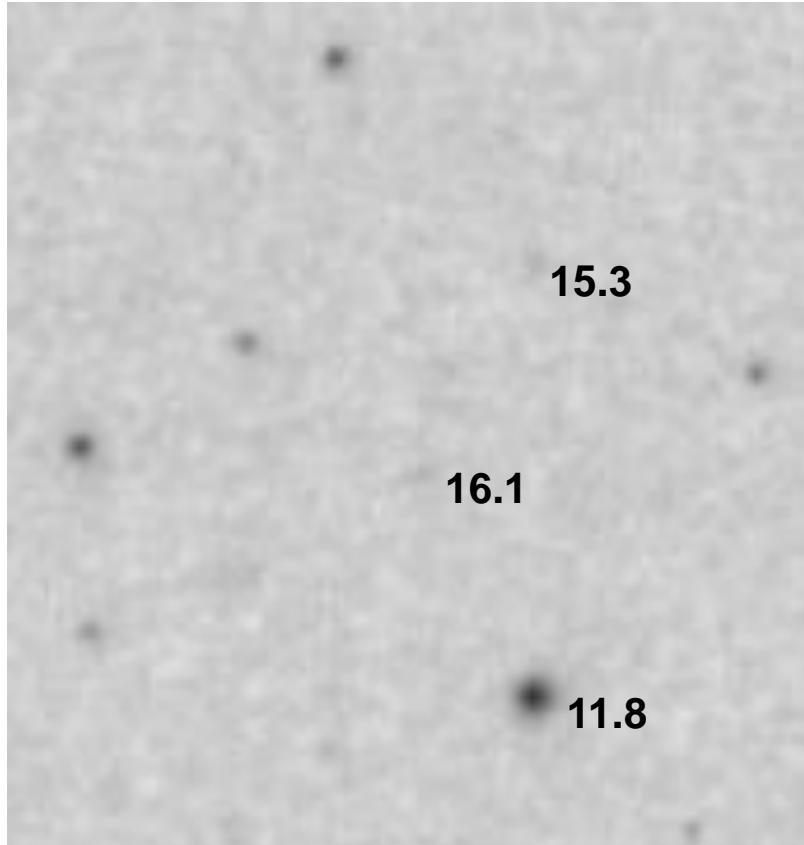


Image of 1401 Lavonne (Vmag=16.1)

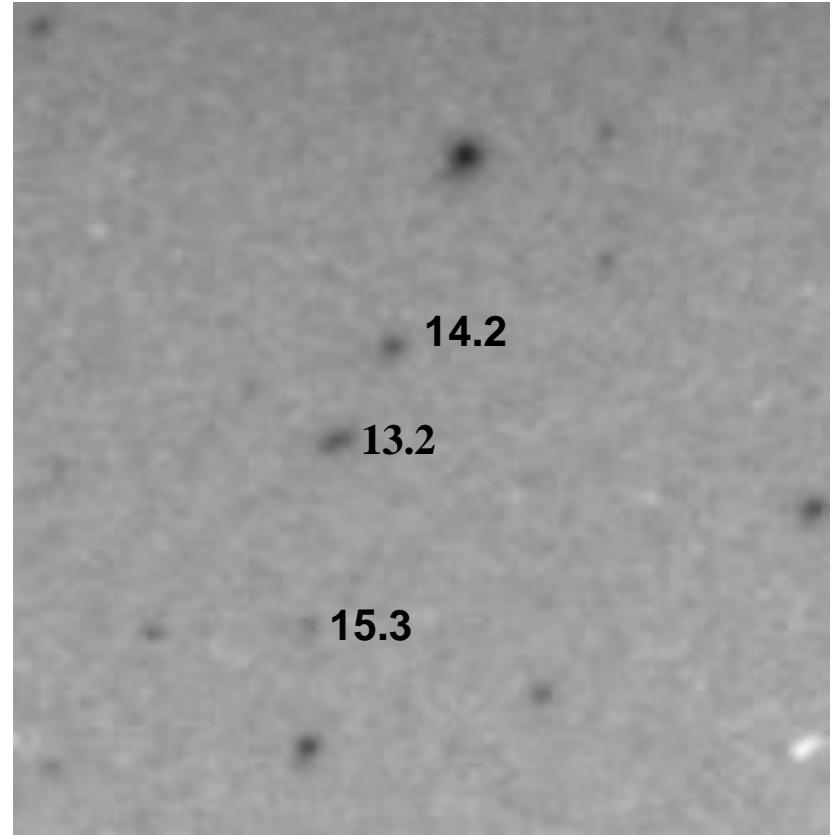


Image of (4179) Toutatis (Vmag=13.2)

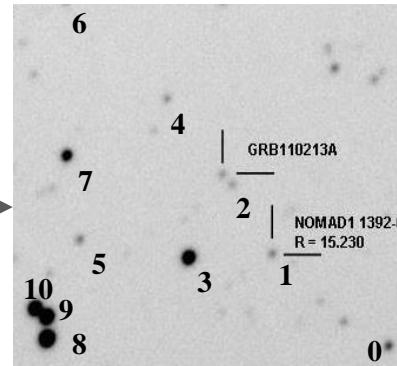
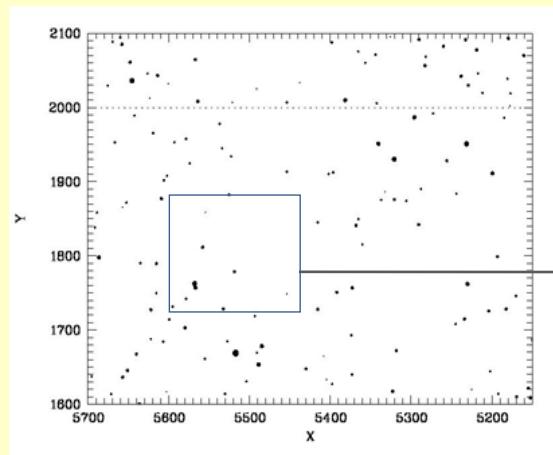
Observed B-magnitudes and residuals $(O-C)_\alpha$ and $(O-C)_\delta$

Ephemerides in JPL			LINUX-MIDAS-ROMAFOT software	
Name	V _{JPL}	R.A.(J2000)DEC _{JPL}	B	$(O-C)_\alpha$, $(O-C)_\delta$
2854 Rawson	15.55	08 ^h 02 ^m 18.739 ^s +19°40'22.168	-	-
4179 Toutatis	13.21	08 03 15.448 +19 59 30.590	13.58	+0.050 ^s +1.150"
1401 Lavonne	15.31	08 08 27.771 +15 45 36.553	16.46	+0.064 +0.144
232 Russia	13.31	08 10 44.601 +14 12 10.399	13.60	-0.030 +0.374
1689 Floris-Jan	14.66	08 12 24.308 +18 56 10.082	14.86	-0.042 +0.629
1249 Rutherfordia	13.66	08 13 17.978 +13 50 38.643	13.83	-0.079 +1.306
1457 Ankara	14.40	08 16 12.243 +19 18 47.036	14.61	-0.032 +0.868
21023 1989 DK	15.45	08 19 50.967 +19 17 03.600	-	-
807 Ceraskia	14.55	08 30 33.604 +15 42 12.304	14.95	+0.127 -0.510

The comparison of the observed coordinates of asteroids with the ephemerides in JPL (HORIZONS SYSTEM).

Residuals $(O-C)_\alpha$, $(O-C)_\delta$ can be improved only by elimination of those reference stars, which coordinates have significant errors, especially stars with magnitudes $B \geq 14m$

Search of optical analogs of GRB and creation of catalogs of objects in the areas around GRBs

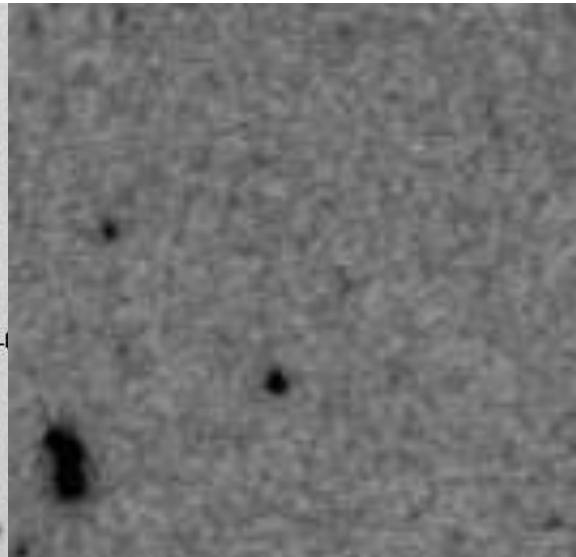
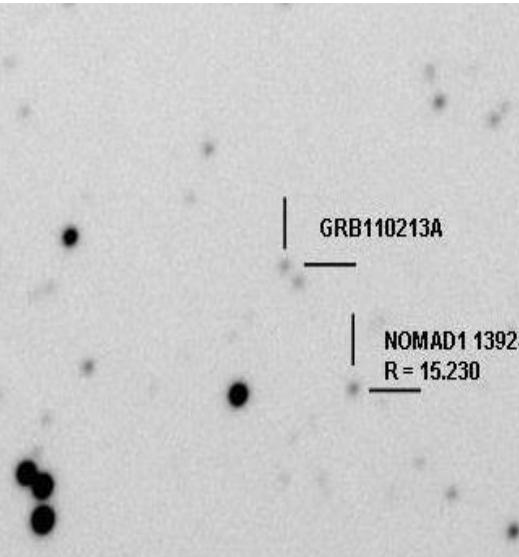
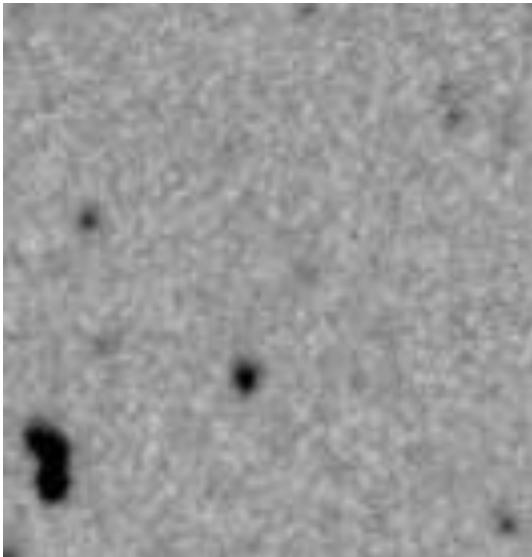


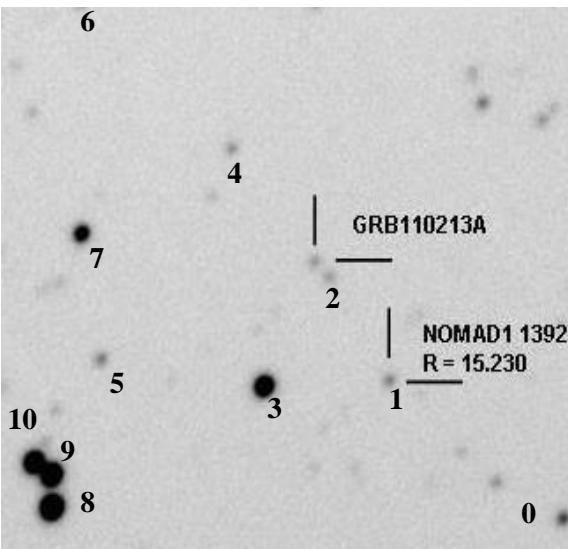
The field 4x4 arcmin around
GRB110213A
with numbered stars from 0 to 10.

Images: Plate 1143A

areas with GCN11709

Plate 514A





Catalog of 8 objects in the areas around GRB 110213A derived from 3 shown plates.

YYYYMMDD	UT	Plates	Exp.min	LimMag
19841019	22:27:46	GUA040C000514A	16.3	16.90
19871023	22:48:58	GUA040C001143A	16.0	17.35
19871223	18:49:42	GUA040C001175	16.2	16.55

<http://194.44.35.19/vo-mao/DB/img/grb/110213A/index.html>

USNOA2

Calculated

N	USNOA2 1350-	RA, J2000 h m s.	DEC, deg ' "	V _{mag}	Cal;RA, J2000 h m s.	DEC, deg ' "	B _{mag}	Plate
0	02790988	025139.70+491425.0	15.5		025139.80+491424.9	15.0	15.0	514, 1143
1	02793520	025147.99+491530.1	16.15		-		-	
2	02794327	025150.72+491616.2	16.4		-		-	
	non-available				025150.86+491816.2	16.3	16.3	1143
3	02795392	025154.21+491530.3	13.7		025154.21+491530.4	13.9	13.9	514, 1143, 1175
4	02795687	025155.29+491715.2	16.15		-		-	
5	02797929	025202.19+491546.1	15.9		025202.24+491545.2	16.1	16.1	1143
6	02797985	025202.34+491823.8	15.5		025202.35+491823.3	14.9	14.9	514, 1143
7	02798171	025202.90+491641.6	14.6		025202.90+491641.5	14.4	14.4	514, 1143, 1175
8	02798758	025204.84+491443.0	13.05		025204.90+491443.1	12.6	12.6	514, 1143, 1175
9	non-available	≈025204.80+491457.1	13.5		025204.94+491455.5	12.3	12.3	514, 1143, 1175
10	non-available	≈025205.66+491502.3	13.7		-		-	

Up to date the analysis of coordinates for 108 GRB, take place in 2003, 2009-2013, has been carried out.

The data of 25 areas are published in GCN Circulars: № 2170, 11385, 11393, 11435, 11596, 11751, 11832, 12113, 12306, 12586, 12680, 12786, 12807, 12808, 12827, 12875, 12906, 12918, 12919, 12979, 12987, 13014, 13063, 13066, 13086.

We obtain catalogues of stars in the vicinity of GRB110213A (4x4 arcmin), GRB101224A (10x10 arcmin).

SUMMARY

- The photographic material of the UkrVO JDA is used for the solution of classic astrometric problem – positional and photometric determinations of objects registered on the plates. The results of tested methods show that the positional rms errors are better than ± 150 mas for both coordinates and photometric ones are better than ± 0.20 m.
- That suggests that old archives can generate new knowledge in addition to current projects and new methods of observations.

References

1. I.B. Vavilova, L.K. Pakuliak et al.: 2012, Kinematics and Physics of Celestial Bodies, 28/2 p.85
2. I.B. Vavilova, L.K. Pakuliak, Yu.I. Protsyuk et al: 2012, Baltic Astronomy, 21, 356-365
3. L. Pakuliak, V. Golovnya et al: Odessa Astronomical Publications, 2013, vol. 26/2, p.236
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