

Ukrainian Virtual Observatory: Joint Archive & Sci. Projects



<http://ukr-vo.org.ua>



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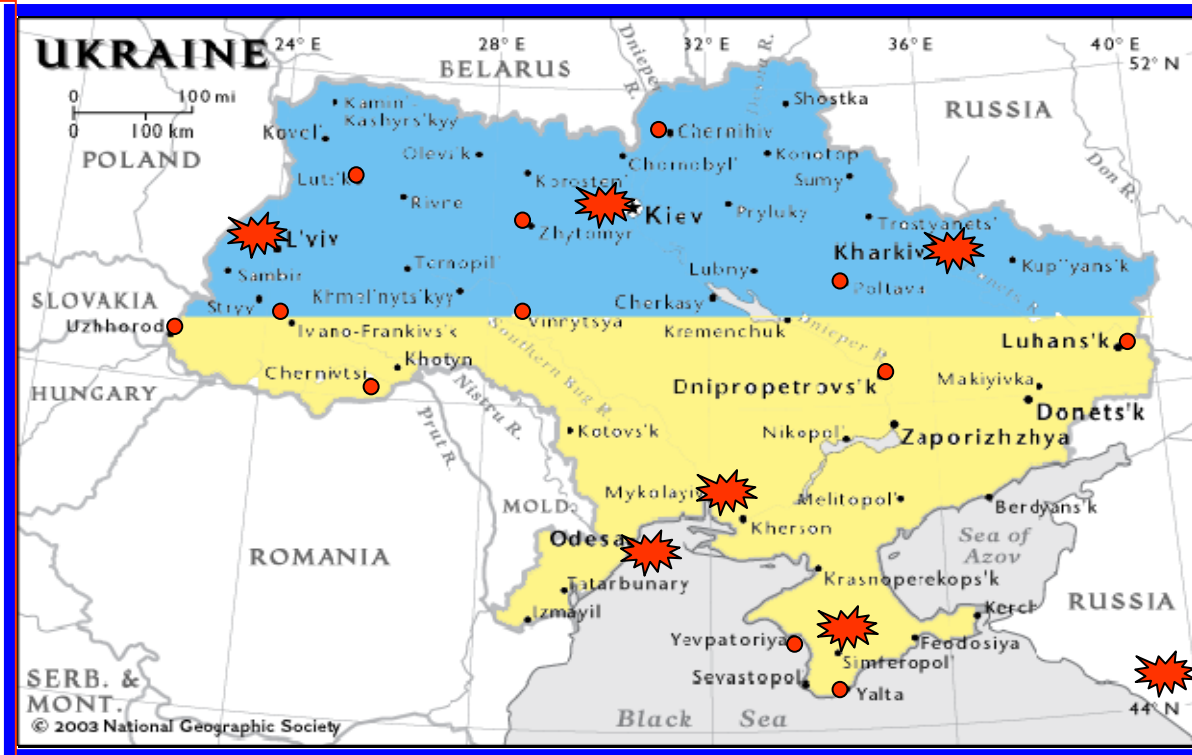
Outline of Report

- * Introduction**
- * UkrVO Joint Archive of Observations**
- * Scientific Projects:**
 - UkrVO Joint Digitized Archive
 - New Stellar catalogues
 - Software for search of the new Solar System bodies



Astronomical Institutions: UkrVO Regional Nodes

- Main Astronomical Observatory (Kyiv 1944)
- Crimean Astrophysical Observatory (Simeiz 1908; Naukove 1945)
- Institute of Radio Astronomy (Kharkiv 1950-ies)
- Mykolaiv Astronomical Observatory (1821)
- Astronomical Observatory Kyiv Nat. University (1845)
- Astronomical Observatory L'viv Nat. University
- Astronomical Observatory Odesa Nat. University (1871)
- Institute of Astronomy Kharkiv Nat. University
- ICAMER (p. Terskol, North Caucasus, RF, 1970-ies)
- Space research Laboratory Uzhgorod Nat. Univ., 1957



Before 2009: 10 Local VO DBs including more 100 subLocal DBs in dependence on the past and current Res. Programs, Instruments, Software etc.
(non-interoperability, wide heterogeneity)



Joint Archive (2009-2011: monitoring, systematization etc.)

	Number Glass Plates (GP) CCD	Years	Sci. Programs	Catalogued & Hard& Soft	Others
MAO NAS of Ukraine	~85,000 GP ~16,000 CCD ~1440 GP spec	1949-1992 2001-2003 1976-1990	Galaxies, QSOs, FON, stars, open clusters, Sol.Sys. small bodies Stellar fields (ICRF) Active Sun	C, H, S	~26,500 direct images; mpg= 11 - 16 ; 2,500 digitized & 1500 PVI
Mykolaiv AO	200 GP 8,405 GP 23,300 CCD	1929-1931; 1961- 1999 1986-2009	Star clusters, Zodiac stars, asteroids, comets	C, H, S	2,700 PVI Finalized!
Crimean AO	~30,000 GP ~100,000 CCD Spec	1938-till now	Galaxies, stars, comets, asteroids, gaseous nebula	C, S	«dBASE III+» format mpg= 16 - 18 ; mv= 12-14 ;
Kyiv AO	200 GP > 20,000	1895-1916 1945-1996	N1916, Moon, stars Fundamental stars, open clusters, QSOs		4,500 systematized; Old collection (before 1916) digitized
L'viv AO	160 GP ~ 8, 000	1939-1976 (160 were taken in 1939-1945)	Comets, Asteroids, Variable stars, N	C, S	~6,000 direct images, in WFPDB `4,000 digitized
Odesa AO	~ 10,000 ~ 10,000 ~ 84,000	1909-1954 Simeiz collection 1945-1956 1957-1998	Variable stars, Comets, Asteroids, EASs. quasars		80% direct images (del: -15 +90 alfa: all) Photometr.homogen.

Our goal – to originate and develop the National Virtual Observatory of Ukraine at the basis of the common unified astroinformation resources of the astronomical institutions of Ukraine in the IVOA standards.

The UkrVO' development allows us

- ***to save*** the unique astronomical observational heritage accumulated in observatories of Ukraine from the 1890-ies
- ***to open*** the wide on-line access to the joint database of digitized astronomic negatives and spectra for the national/foreign scientific community
- ***to create*** the technical and structural preconditions for joining the UkrVO to IVOA in 2011.



Main Tasks

- **Joint Digitized Archive (both Photogr. & CCDs)**
- **Spectral Archives** (by instruments, by objects, from decameter radio to gamma e.m.w. ranges)
 - **Catalogues of celestial bodies**
 - **IT-resources and VO-instruments**
 - **Science with VO**



Sci. #1

UkrVO Joint Digitized Archive
(~200,000 glass plates)



Sci.1 Joint Digitized Archive

(available DB' resource and on-line access)

Observatory	Number of observ. archives	Number of instruments	Years	Type of astroInfor mation	Number of images	Celestial bodies
MAO NASU	26	14	1949-2003	Direct images	2,500	Galaxies, stars, radiosources, Sol. Sys SB
Mykolaiv AO	2	2	1929-1931, 1961-1999	Direct images	4,000	Sol. Sys. SB, Near polar & zodiacal zones
	3	3	2003-2009	CCD	23,300	Equatorial zone
Crimean AO	7	7	2001-2010	CCD	1,033,000	Galaxies, stars, GBs
	10	4	1968-2010	Spec	96,000	
L'viv AO	1	1	1939-1976	Direct images	1,700	Variable stars, Sol.Sys. SB

Mykolaiv VO

Number of plates in the database: 34198

RA and Dec (h m d m OR d d):
 Sizes of search region (RA, Dec), deg:
 Period of observations (YYYY MM DD): from to
 Observations with: ☒ photo plates ☒ CCD

Observational campaigns with photo plates

☒ Stars: 1252 plates

☒ Stars around Radio Source: 485 plates

☒ Stellar Cluster: 2350 plates

☒ Double or Multiple Star: 987 plates

☒ Variable Star: 1842 plates

☒ Nebula: 48 plates

☒ Supernova (remnant): 18 plates

☒ Fundamental Star: 2105 plates

☒ Association of Stars: 4 plates

☒ Stars around the Pole: 276 plates

☒ Zodiac Stars: 1127 plates

☒ Equatorial stars: 489 plates

☒ Planet: 4261 plates

☒ Moon: 854 plates

☒ Asteroid: 4527 plates

☒ Comet: 1603 plates

☒ Artificial Satellite: 4156 plates

☒ Field: 5925 plates

☒ Radio Source: 211 plates

☒ Undefined object: 52 plates

☒ Galaxy: 1320 plates

☒ Quasi-Stellar Object: 162 plates

☒ Group of Galaxies: 139 plates

☒ Cluster of Galaxies: 5 plates

Optional parameters of photo plates

Optional telescopes for photo plates

Observational campaigns with CCD

Optional parameters of CCD frames

Optional telescopes for CCD observations

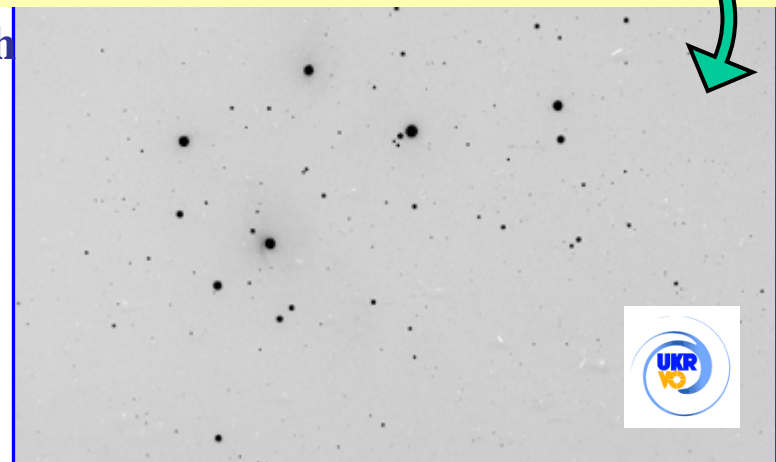
Login, password

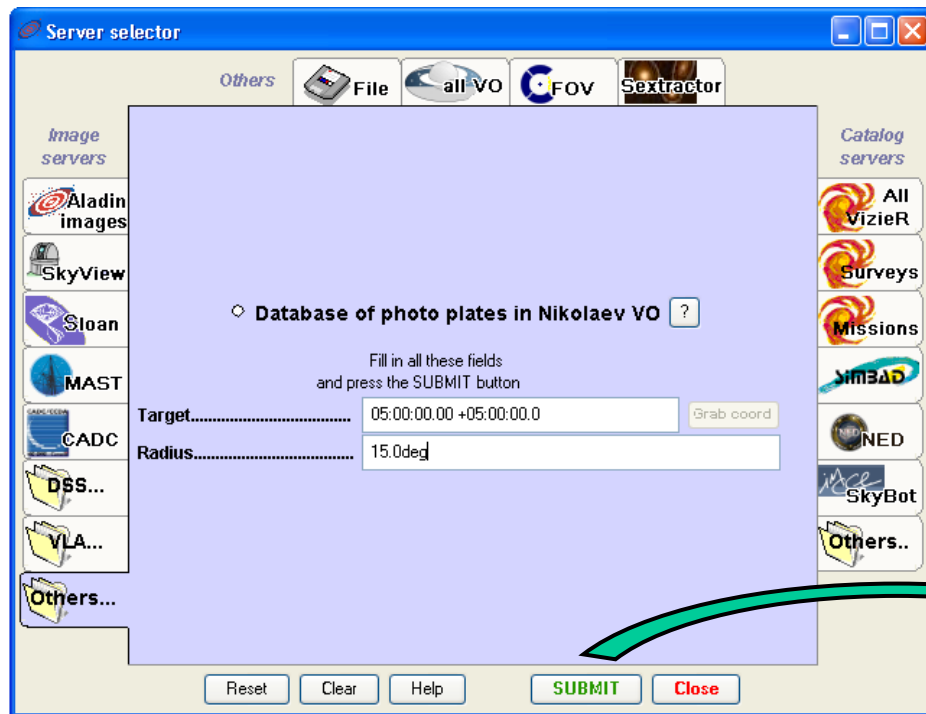
s	Dec, d:m	Y/M/D	Object	Link
35	+02:47	1955/09/20	Field	-
38	-01:24	1988/09/18	Mars, Deimos, Fobos	-
38	-01:24	1988/09/18	Mars	-
18	+04:05	1988/12/10	Mars	-
30	+01:13	1967/10/04	Saturn	preview
33	-01:19	1988/09/17	Mars, Deimos, Fobos	-
42	+01:15	1967/10/03	Saturn	preview
42	+01:15	1967/10/03	Saturn	preview
01	-06:53	1979/12/14	(1) Ceres	-
01	-06:53	1979/12/14	(1) Ceres	-
04	-01:12	1988/09/21	Mars	-
33	+02:39	1963/11/27	Jupiter	-
33	+02:39	1963/11/27	Jupiter	-
57	+02:40	1963/11/24	Jupiter	-
00	+02:00	1990/08/29	Equatorial catalog	-
00	+02:00	1990/08/29	Equatorial catalog	-
00	-02:00	1990/09/24	Equatorial catalog	-
00	-02:00	1990/09/24	Equatorial catalog	-
29	-03:50	1980/09/05	(40) Harmonia	-
29	-03:50	1980/09/05	(40) Harmonia	-
48	-00:51	1988/08/07	Mars	-
00	+02:45	1963/11/15	Jupiter	preview
00	+02:45	1963/11/15	Jupiter	preview
29	-01:52	1988/09/16	Field	-
26	-00:20	1996/11/09	Juno	preview
38	-01:08	1957/11/22	4 Vesta	-
44	-01:08	1957/11/21	4 Vesta	-

Number of found plates in the table: 299

Database provides an opportunity to search plates and/or CCD frames by using equatorial coordinates, radius of search region, period of observations, names and types of objects, names of telescopes.

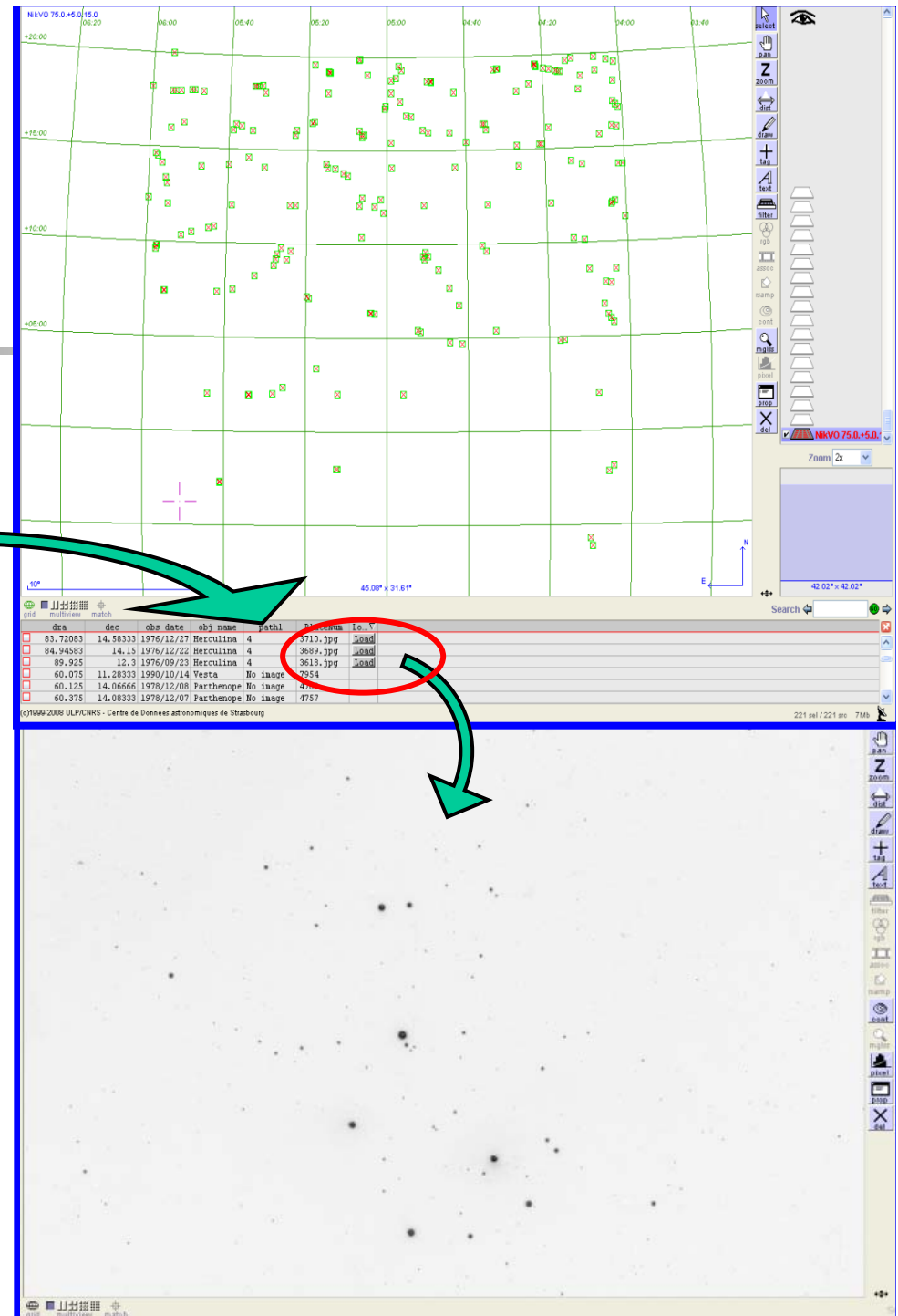
Access to the preview images is shown.
Database includes about 34,000 plates and 23,000 CCD frames.





Databases of plates and CCD frames are available via Aladin interface. The same databases are used via browser and Aladin.

Visualisation process of search for plates is shown.





Ukrainian Virtual Observatory

Stellar catalogues in VOTable format:

- Catalogue of 1720 stars (1832-1834)
- Catalogue of 5954 stars (1876-1899) *CDS, Strasbourg*
- Absolute declinations of 172 stars at mean epoch of 1925.0
- Absolute declinations of 707 stars (1929-1939)
- Absolute declinations of 587 stars (1939-1941, 1945-1951)
- Absolute declinations of 710 stars (1957-1964)
- Visual observations in the declination range $+90^\circ$ to -30° were carried out with the Repsold vertical circle. 187 stars were observed in both culminations. Systematic instrumental errors were taken into account during the reduction process.
- VOTable**
- Absolute right ascensions of 674 stars included in the FK3 (1929-1935)
- Absolute right ascensions of 571 stars included in the FK3 (1939-1941, 1945-1950)
- Absolute right ascensions of 626 stars (1959-1963)
- Absolute right ascensions of 431 stars (1973-1975)
- Right ascensions of 64 stars included in the FK3 (1947-1952)
- Right ascensions of 64 stars (1953-1955)

27 astrometric stellar catalogues with short descriptions in VOTable format are available for downloading from the web site. One can visualize and use any catalogue via Aladin or any other stand alone application.

The screenshot displays the Ukrainian Virtual Observatory (UKR VO) interface. The 'Server selector' window is open, showing a list of catalogues and a section for 'Server data access (image/table/script/dir)'. A green arrow points from the 'VOTable' entry in the list to the 'Server data access' section. The 'Server data access' section contains a text input field with the path 'R:\ccd_1\VOTable\'. Below the input field is a 'Browse...' button. The 'Server selector' window also features a 'File' button and a 'SUBMIT' button. To the right of the 'Server selector' window is a 3D visualization of a stellar catalogue, showing a dense field of stars in a spherical coordinate system. The visualization is titled '360° x 180°'. Below the 3D visualization is a table of star data, including columns for 'ra', 'dec', 'mag', 'epoch', 'numObs', 'diffFC3', 'numFC3', and 'starBus'. The table contains several rows of data, including star names like '176.37248323', '180.3897291', '185.60078745', '186.55110745', '187.90458575', and '194.67286245'. A green arrow points from the 'SUBMIT' button to the table. The interface also includes a 'Catalog servers' section with links to 'All VizieR', 'Surveys', 'Missions', 'SimBAD', 'NED', 'SkyBot', and 'Others..'. The bottom of the interface shows a status bar with the text '99-2009 USJCNRS - Centre de Données astronomiques de Strasbourg' and a search bar.

ra	dec	mag	epoch	numObs	diffFC3	numFC3	starBus
176.37248323	+14.963333	2.23 A2	1930 F119	-	444	332	
180.3897291	+9.121666	4.24 G5	-0.0149 1932.01.15	-	450	336	
185.60078745	+39.406666	5.72 A2	-0.007 1932.07.17	-	461	344	
186.55110745	+21.203333	5.72 A2	+0.0017 1932.15.17	-	466	345	
187.90458575	+18.761666	5.13 K0	+3.0105 -0.0004 1932.11.17	-	473	351	
194.67286245	+11.335	2.95 K0	+3.0051 -0.0005 -0.0106 1931.07.30	-	489	360	



UKRAINIAN VIRTUAL OBSERVATORY

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популярные Speed Dial Делая дані (бэкап) Киев - Лондон - Бюд... New Horizons in Time... British Airways - Чоо... В У Кантаре | И-Ю

OBSERVATIONAL ARCHIVES OF JDA PROTOTYPE

WFPDB Instrument Identifier	Original Name(Addr) of the Instrument/ [Type]	Location of the Archive [Astronomer in Charge]	Observatory	Marsden's No./ Arch.Type/ Neg.Type	Time Zone	East Long./ Latitude/ Altitude (m)	Clear Aperture/ [Mirror Diameter (m)]	Focal Length(m)/ [Scale ("/mm)]/ Field Size [deg]	Years of Oper.	Number of Direct Plates
KA0020A	DAMR [Ast]	Kyiv, Ukraine [Kazantseva L.V.]	Observatory of Kyiv Shevchenko National University Kyiv, Ukraine	085 comp.readable glass	2	30 30 50 27.2 186	20	4.26 [48] 1.7	1946-1999	1000
KA0070A	AZT8 [Rf]	Kyiv, Ukraine [L. Kazantseva]	Astronomical Observatory, Kyiv Shevchenko National University Lysnyky, Ukraine	585 printed tab. glass	2	30 31 50 17.9 156	0 [0.7]	2.8 [90.7] 0.2	1919-1990	1000
LA0010	Zeiss 50/10 [Ast]	Lviv, Ukraine [N. Virun]	Astron.Observ.Lviv Nat.University Lviv, Ukraine	067 printed tab. glass	3	23 57 49 55 359	10	0.5 [412] 1	1939-1976	8500
MAJ060	Zeiss-600 [Rf]	Kyiv Ukraine [V.Golovnya]	Majdanak Obs. Kyiv Station Uzbekistan	188 comp.readable glass	5	66 52.8 38 41 2600	0.6 [0.6]	7.5 [28] 0.5	1986-1991	544
MYK012	ZZA [Ast]	Mykolayiv,Ukraine [G. Pingim]	Mykolayiv Ast. Obs. Mykolayiv, Ukraine	089 comp.readable glass	2	31 58.5 46 58.3 83	12	2.04 [101] 5	1961-1999	8209
PUL012	ZZA [Ast]	Mykolayiv,Ukraine [G. Pingim]	Main Astr.Observatory Pulkovo Russia	084 comp.readable glass	3	30 19.6 59 56.3 75	12	2.04 [101] 5	1929-1931	196
QUI021A	CA [Cam]	Kyiv Ukraine [V.Golovnya]	Quito Astron. Obs. Quito, Ecuador	781 comp.readable film	-4	-78 29.3 0 12.6 2860	0.210	0.74 [281] 10.6	1986-1986	66

http://212.111.210.10/ukrvo/db/vo3_results.php

Centre of search region (RA, Dec): 50.00°, 24.00°
Size of search region (RA, Dec): 5°, 5°
Time period of observations (Y/M/D): from 1929/01/01 to 2011/01/01

Number of plates in the database: 34198

Plate	RA, h:m:s	Dec, d:m	Y/M/D	Object	Link
GUA040C 001730A	03:12:02	+24:05	1990/10/13	Northern sky survey	-
MYK012 004179	03:14:54	+24:11	1977/10/11	Zodiac catalog - A	-
MYK012 005529	03:22:54	+22:11	1980/10/17	Zodiac catalog - B	-
GUA012B 000276	03:22:57	+24:10	1951/10/28	The Pleiades	-
GUA012B 001282	03:22:57	+24:10	1959/11/28	The Pleiades	-
GUA012A 000276	03:22:57	+24:10	1951/10/28	The Pleiades	-
MYK012 005617	03:23:00	+26:11	1981/01/04	Zodiac catalog - B	-
GUA040A 000902B	03:27:37	+21:40	1972/03/29	Venus	-
GUA040A 000903B	03:27:37	+21:40	1972/03/29	Venus	-
GUA040C 001887	03:27:43	+21:58	1991/10/12	Northern sky survey	-
GUA040C 001724A	03:27:51	+24:06	1990/10/11	Northern sky survey	-
MYK012 002302	03:28:00	+21:41	1972/03/29	Venus	-

Number of found plates in the table: 13

Elapsed time: 0 s

JOINT DIGITAL ARCHIVE prototype

http://194.44.35.19/vo-mao/db/data_search.php

(DBGPA V2.0)

OUTPUT PREFERENCES SEARCH PLATES: FIELD OVERLAP OBJECTS BY IDS OR NUMBERS GUIDES SPECIALS V1.0

You've inquired:
RA= 50° 0' 0" DEC= 24° 0' 0"
Area round dimensions: radius= 5 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 h:m:s	DEC d:m:s	Date	Expos. min	Dimensions cm	Instrum.	Place of Storage
	GUA012A000310A	00 00 00	+19 00 00	530522	3	18x24	DSA	The plate is not available
	GUA012B000026	00 00 00	+26 00 00	490824	5	18x24	DSA	The plate is not available
	GUA012B000310A	00 00 00	+19 00 00	530522	3	18x24	DSA	The plate is not available
	GUA012B000049	00 00 00	+26 00 00	490830	2.5	13x18	DSA	sh.220 box26
	GUA040C001511A	00 00 04	+28 02 42	891019	0.5	30x30	DWA	sh.314 box33
	GUA040A002508	00 11 37	+22 29 25	621013	20	24x24	DLA	sh.346 box42
	ABA039802758	00 17 00	+25 30 00	880108	6	9x9	SCHC	sh.354 box11
	MYK012 005462	00 19 30	+28 22 00	800904	5	24x24	ZZA	Available in Mykolayiv Astronomical Observatory, Ukraine.
	MYK012 005458	00 20 00	+28 32 00	800904	5	24x24	ZZA	Available in Mykolayiv Astronomical Observatory, Ukraine.
	ABA0398027764	00 23 45	+26 25 07	880109	6	9x9	SCHC	sh.354 box11
	ABA0398027765	00 23 47	+26 20 57	880109	6	9x9	SCHC	sh.354 box11
	GUA040C001514B	00 03 39	+27 51 08	890923	0.7	30x30	DWA	sh.301 box12
	LA0010 003567	00 05 00	+28 35 00	561001	50	13x18	Zeiss50/10	Available in the AO of Franko university, Lviv, Ukraine
	ABA0398029807	00 05 00	+28 00 00	900602	6	9x9	SCHC	sh.354 box11
	GUA040E000457	00 05 15	+23 15 57	820301	6	24x24	DWA(C)+ASC	The plate is not available
	GUA040D001775	00 05 30	+27 57 30	880718	5	30x30	DWA	sh.346 box42

- 1 - Observational archives, currently included in JDA prototype
- 2 - Search Interface of Nikolayev AO for JDA data
- 3 - Search Interface of MAO NASU for JDA data

* joint results of search are highlighted



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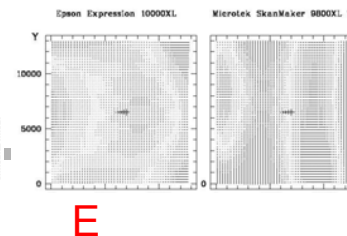
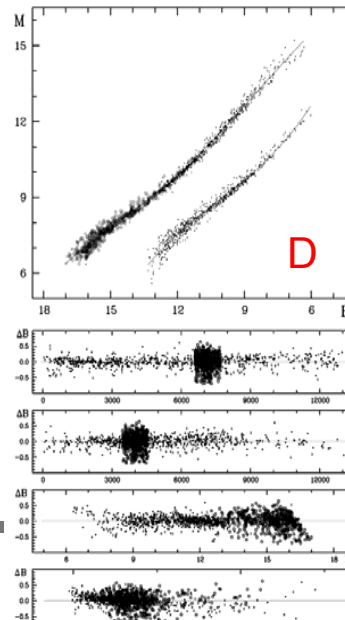
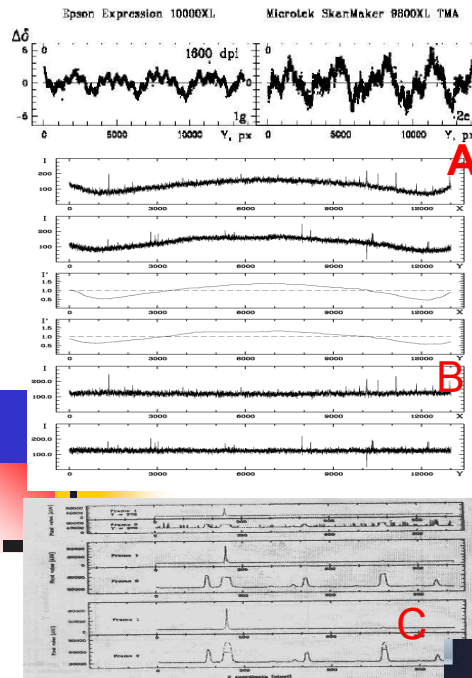
LINUX/MIDAS/ROMAFOT based calibration software

The initial processing of digitized images with calibrating software includes finding and eliminating of own flat field of the plate (B), finding and selection of objects, removing of «hot» pixels, restoration of overexposed images (C), removing of scanner mechanics errors (A).

(D) - photometric characteristics for two exposures

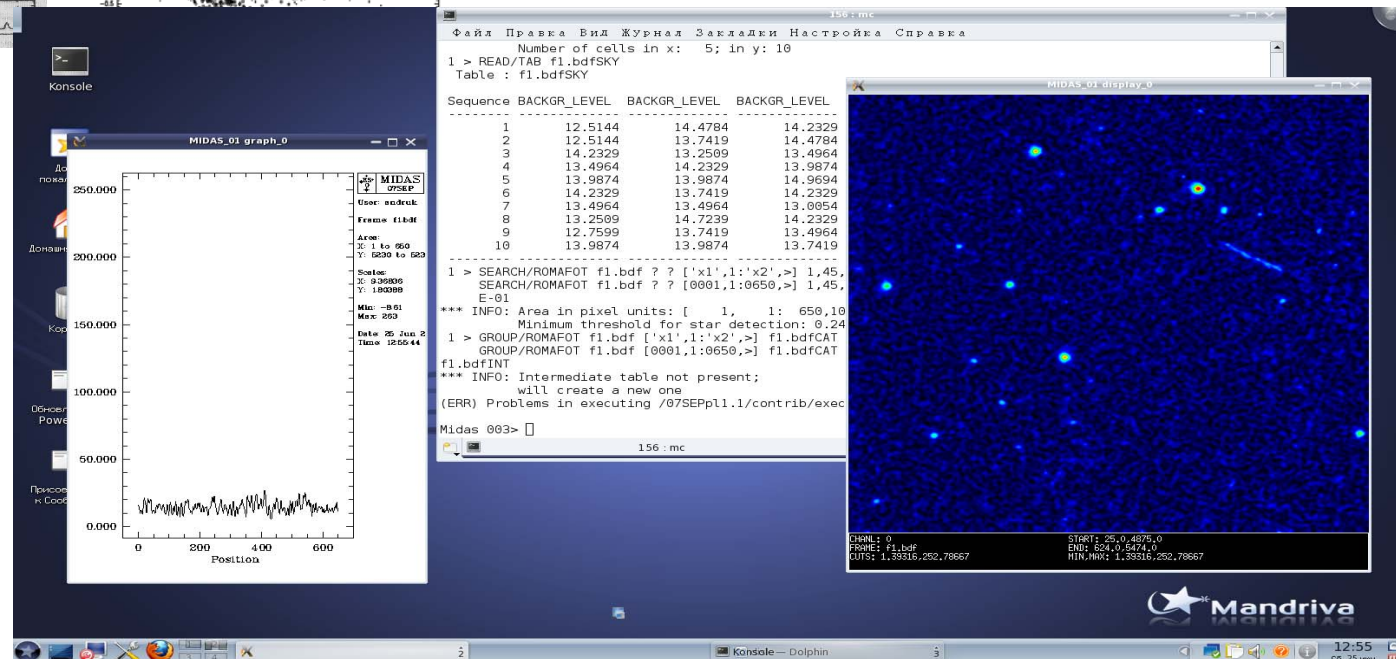
(E) - positional systematic differences over the field of plate

(F) - internal positional accuracy for 2 scanners



Epson Expression 10000XL					Microtek ScanMaker 9800XL TMA				
n	B	σ_B	σ_C	N	n	B	σ_B	σ_C	N
1	6.55	0.123	0.099	17	1	6.81	0.395	0.435	4
2	7.64	0.092	0.098	30	2	7.66	0.369	0.383	25
3	8.59	0.113	0.095	95	3	8.59	0.263	0.239	100
4	9.58	0.087	0.087	275	4	9.60	0.159	0.145	281
5	10.56	0.081	0.088	659	5	10.59	0.128	0.127	721
6	11.59	0.080	0.084	1851	6	11.58	0.117	0.117	2024
7	12.44	0.089	0.091	2099	7	12.45	0.128	0.128	2416
8	13.29	0.090	0.103	386	8	13.31	0.137	0.136	512
9	14.21	0.110	0.108	13	9	14.22	0.129	0.200	19
11.73	0.085	0.089		5425	11.80	0.130	0.129		6103

Яценко А.И., Андрук В.Н.,
Головня В.В., Пакуляк Л.К.,
Иванов Г.А. Результаты
сканирования снимков 60-й
зоны программы ФОН –
методика редукции измерений,
характеристика выходного
каталога //
Кинематика и физика небес.
тел. –2011. –27, №5. –С. 49-59
(Yatsenko A. et al, Kinematics
and Physics of Celestial Bodies,
2011,- V.27,- №5P.- 49-59,
in Russian).





Mykolaiv Plate and CCD Archive

Crimean Plate and CCD Archive

- The virtual observatory of the **Mykolayiv Astronomical Observatory** is under the final stage of its development. *Database of observations with access via Aladin*: Database contains textual information about 7437 plates and 933 preview images. Plate scale: 100"/mm. Observational campaigns in: 1929-1931 and 1961-1999. Limiting magnitude: B=14m. Database contains textual information about 16660 CCD frames obtained with the AMC, the MCT and the FRT in 1996-2006. Database also gives links to 280 CCD frames obtained with the AMC in 2002-2003. Limiting magnitudes are R=16m, 14m, 18m for the AMC, the MCT and the FRT, correspondingly. *Astrometric catalogues of star in VOTable format* and other archives are available through Web-page: http://www.mao.nikolaev.ua/ukr/vo2_u.html
- In the database of **Crimean Astrophysical Observatory** the digitized plate archive is stored in «dBASE III+» formats and comprises the data of photographic observations of stars down to 12m -14m in photo visual waveband and down to 16m-18m in photographic waveband. The time intervals of these observations cover 1938-1965, 1984 yrs. Crimean archives are included into global WFPDB.

■



Golosiiv Plate Archive

- The collection of glass plates in the archive of **Main Astronomical Observatory NASU** (Golosiiv plate archive – hereafter GPA) numbers near 85 thousands of negatives obtained in frames of various observational projects and starts in 1949. More than 26 thousands of them are the direct plates in the areas of the northern sky. The limiting magnitude of the most plates is 14m.0 – 16m.0.

The vast amount of information, contained in this archive, its partial regulation and absence of the unified systematization didn't allow to use the archive either in total efficiently or to find separate plates quickly. At the moment when photographic observations had been totally stopped, a sheer necessity arose to order and classifies all the information collected in MAO NASU during more than 60 years of observations. The process started in 2000 with mere ordering of boxes with plates, analyzing characteristics of plates from the point of view which instruments were applied, which goals were pursued and formats were developed for the observational log data digitizing.

GPA collection was obtained generally with the telescopes, installed in MAO NASU. 85% of the northern sky observations are conducted with five instruments: Double Long Focus Astrograph – 10.5 thousands of plates, Double Wide Angle Astrograph – 9.7 thousands of plates, Double Short Focus Astrograph – 4.2 thousands of plates, Three Camera Astrograph – 1 thousand, stellar telescope AZT-2 – 1.1 thousands. The residue of plates was obtained on four foreign instruments in Ecuador, Uzbekistan and Russia.

See DBGPA V2.0 <http://gua.db.ukr-vo.org>



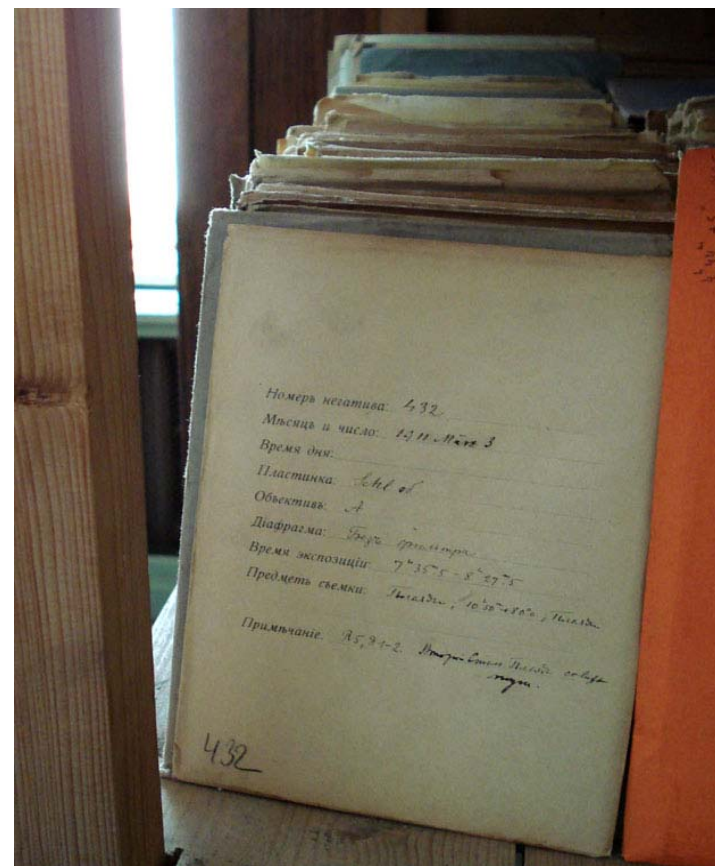
**Astronomical Observatory, Odesa National University,
Simeiz archive (1909-1954) – 10,000 glass plates**



Simeiz collection

**In 1966 the Simeiz (Crimean)
collection
of about 10,000 glass plates
exposed in 1909-1953
was conveyed to Odesa AO.**

*Record at the envelope with a
glass plate is dated
by March 3, 1911*

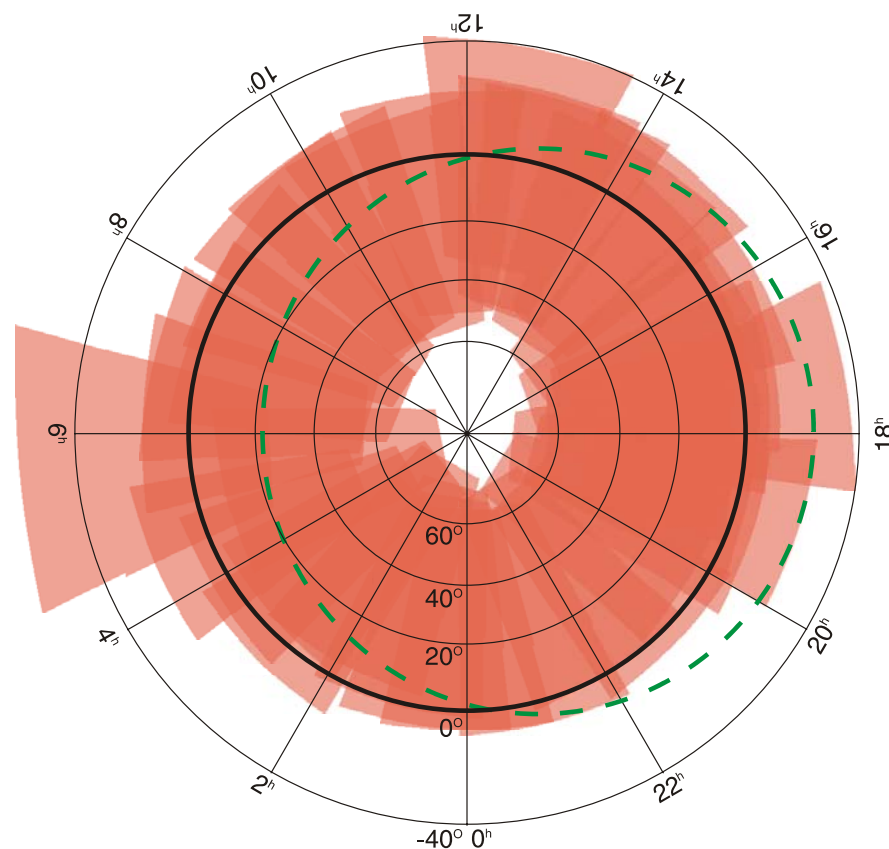
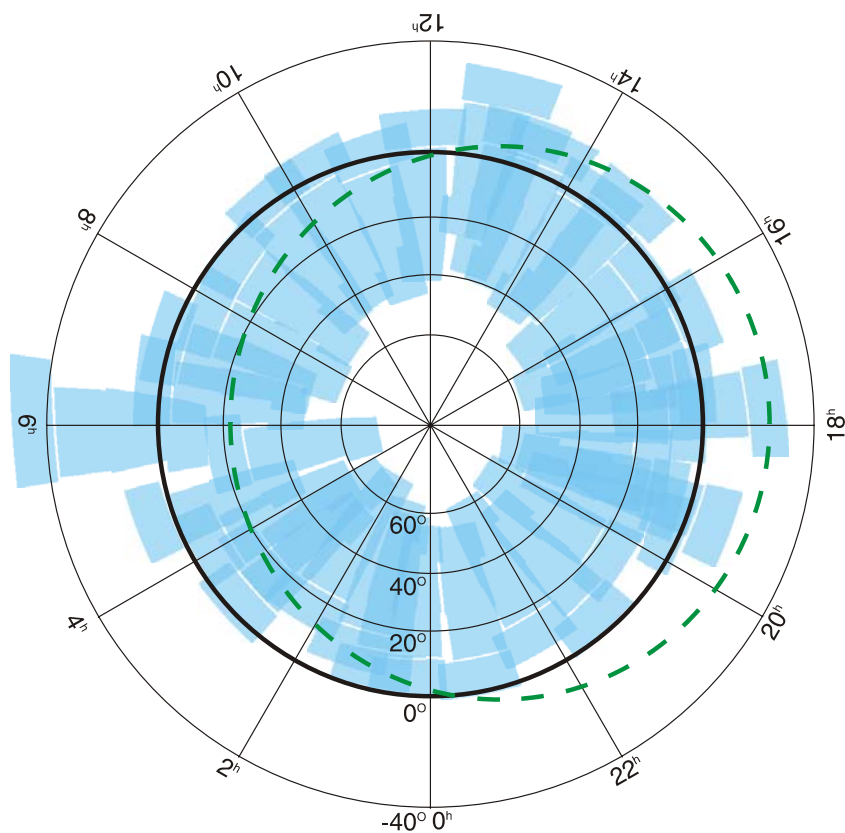




Astronomical Observatory, Odesa National University
Astronegative's archive (1957-1998, photometrically
homogeneous, $m_v=12$ $m_{pg}=15$) – about 84,000 plates



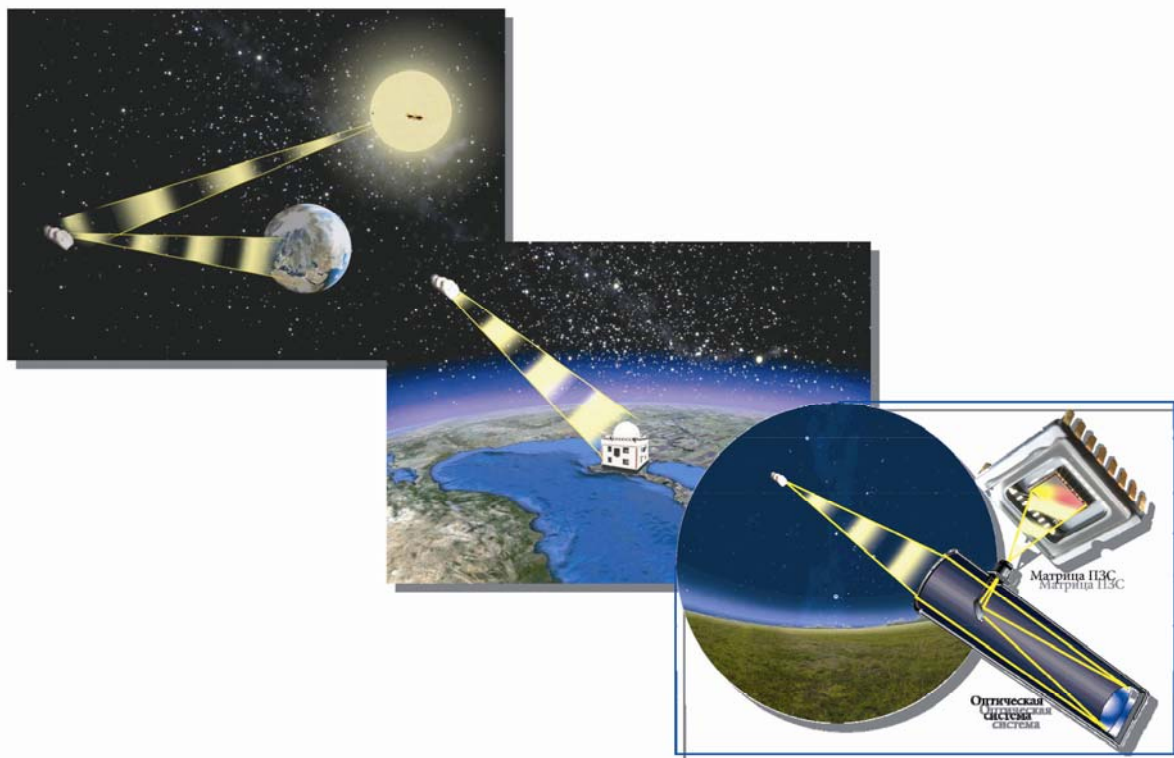
Scheme of covering the sky by the fields of 3, 4, 5, and 6 cameras, III series (blue) and of 1, 2, and 7 cameras, III series (red), 7-camera astrograph





Sci. 2. Software for the search of the new Solar System small bodies

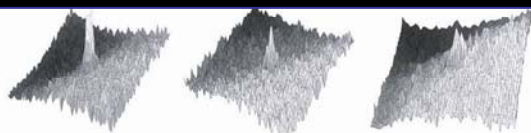
Formation of CCDframe with the asteroid image





Sci. 2. Software for the search of the new Solar System small bodies CoLiTec (Savanevich et al.)

Estimation of SB' coordinates at the discrete image



Examples of SB' signals Law for distribution of photons coordinates at CCD frame

$$f(x, y) = A_{noise} x + B_{noise} y + C_{noise} + \frac{p_1}{2\pi\sigma_{ph}^2} \exp\left\{-\frac{1}{2\sigma_{ph}^2}[(x-x_r)^2 + (y-y_r)^2]\right\},$$

where $p_1 = 1 - p_0$, $p_0 = \int_{x_{beg}}^{x_{end}} \int_{y_{beg}}^{y_{end}} (A_{noise} x + B_{noise} y + C_{noise}) dx dy$, p_1 - relative weight of SB' signal, p_0 - relative weight of CCD noise photons, $A_{noise}, B_{noise}, C_{noise}$ - parameters of field substrate noise, σ_{ph} - RMS coord. of falling photons, x_r, y_r - SB' coordinates at t-frame.

Relative frequency of falling photons in ik-pixel at t-frame:

Possibility of falling photons in ik-pixel at t-frame:

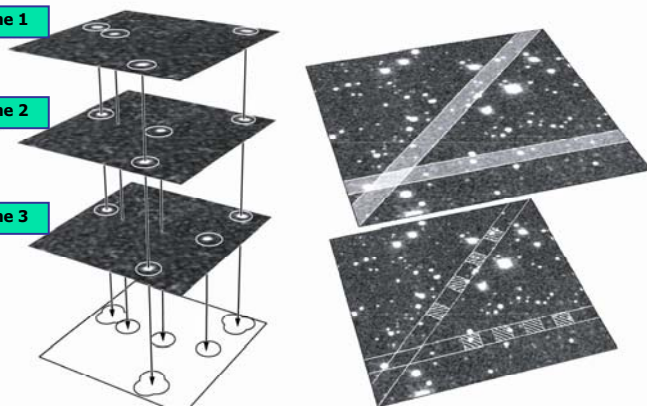
$$v_{ik}^* = \frac{A_{ik}}{\sum_{i,k} A_{ik}}$$

$$v_{ik}(\Theta) = \int_{x_{beg}}^{x_{end}} \int_{y_{beg}}^{y_{end}} f(x, y) dx dy$$

Frame 1

Frame 2

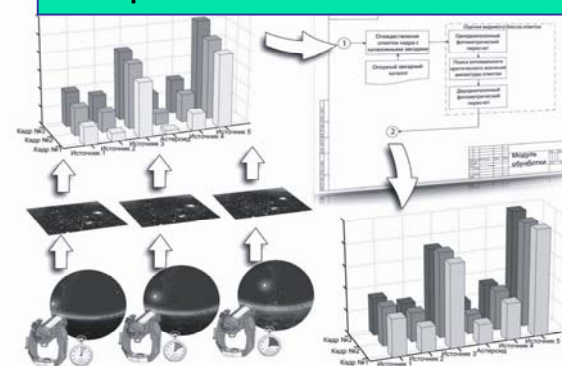
Frame 3



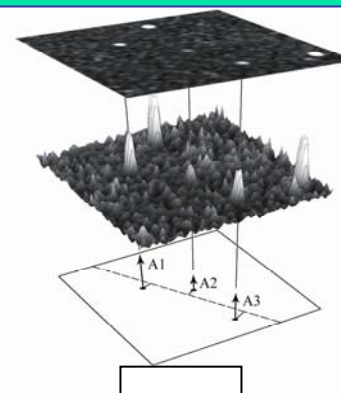
Removal of fixed object

Two-steps

Estimation of SB' signal light by amplitude of its mark on the CCD frame



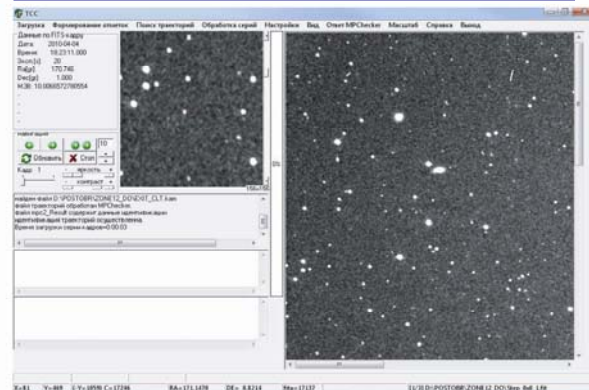
Amplitude-coordinate Small body' trajectory finder at frame series





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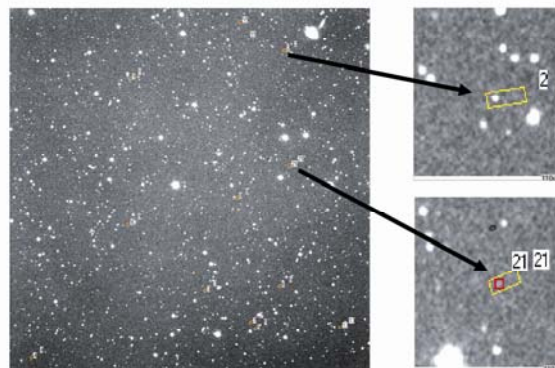
Frame's loading and accounting of residual noise at image



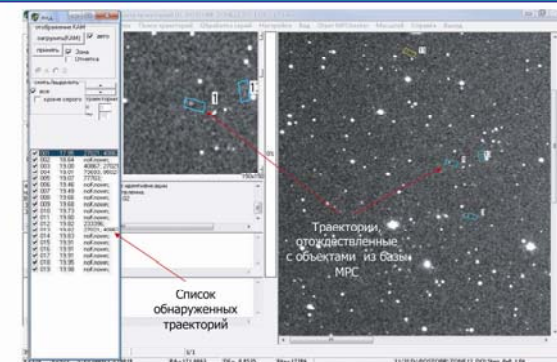
Identification of stars with the use of stellar catalogues



Hand-make filtration of observational results



Online comparison of obtained measurements with PC database. Identification of known objects?





Sci. 2. Software for the search of the new Solar System small bodies

SoLiTec software Users



Андрюшевская (Киев) астрономическая обсерватория (ААО)
Andrushivska Observatory (Ukraine)
Zeiss-600, FLI PL09000 CCD camera



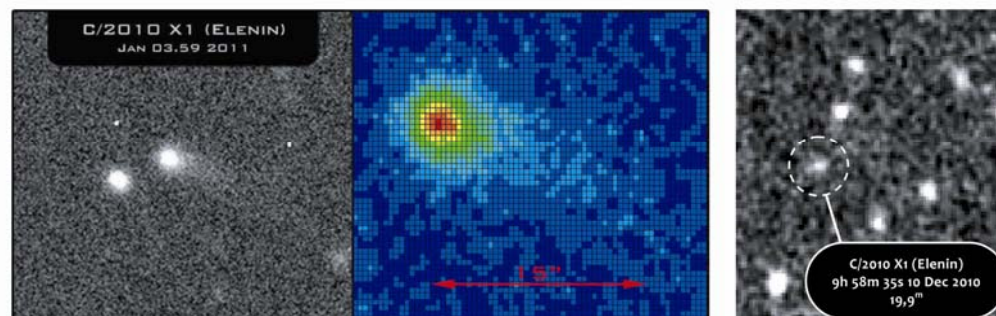
ИССО-Мексико
Russian observatory ISON-NM located in New-Mexico, USA
Astrograph Astroworks Centurion-18, D-45 cm



On the use of SoLiTec software: after its input into trial operation there were discovered about 200 new asteroids (for example more than 30 at Andrushivka observatory and 133 at ISON-NM observatory (only in period 27.12.10-03.01.11)). This software is successfully used in frame of the Space debris program at the National Space Centre (Evpatoria, Ukraine)

Observatory ISON-NM

Discovery C/2010 X1 (Elenin) comet



December 10, 2010. Comet c/2010 X1 was discovered by Elenin with the use of SoLiTec software



Conclusion– UkrVO Sci. Projects

- Creation of the UkrVO Joint Digital Archive
- Software for JDA and for the local data archive of observatories
- Science with UkrVO JDA
 - new stellar catalogue (for fainter objects)
 - search for new Solar System small bodies (small planets, transneptunian objects, comets, space debris)
 - search and study for variable stars
 - search for GRB's counterparts
 - multi-wavelength extragalaxy research (cross-correlation of ground-based long-term monitoring data in optical with the data from space mission in X-ray, gamma for estimation, for example, the black hole mass in AGNs)
 - study of solar active formations and their evolution during the solar activity cycle



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UKRAINIAN VIRTUAL OBSERVATORY

UkrVO site <http://ukr-vo.org.ua>

will be opened in July, 2011.

We are planning to apply the UkrVO for
the IVOA membership in 2011.

Thank you for your attention!