

UKRVO JOINT DIGITAL ARCHIVE: CURRENT STATUS AND PERSPECTIVES

L.Pakuliak ¹, V.Golovnya ¹, N.Virun ², L.Kazantseva ³, S.Kashuba ⁴

¹ Main Astronomical Observatory NAS of Ukraine, Kyiv, Ukraine,
pakuliak@mao.kiev.ua

² I.Franko Lviv National University, Lviv, Ukraine

³ T.Shevchenko Kyiv National University, Kyiv, Ukraine

⁴ I.Mechnikov Odessa National University, Odessa, Ukraine

ABSTRACT. We discuss the current state of the UkrVO joint digital archive of photographic astronomical observations and the basic problems of its creation.

Key words: virtual observatory, UkrVO, database, digital archive

UkrVO project was originally conceived as a method of combining all the archives of astronomical observations of Ukrainian observatories. The project was supposed to include the data obtained in all wavelength ranges, not only optical or photometric. Such an association should provide data search and filtration in old archives, allow its regular replenishment with data of modern observational projects in any technological solutions, provide software tools for sharing early and recent observational data, thus carrying out the process of data mining (Vavilova et al., 2012a, 2012b, 2011, 2010; Pakuliak et al., 2012).

At the initial stage, this task involves the creation and development of joint digital archive (JDA) of photographic observations. The total number of photographic plates in the collections of Ukrainian observatories exceeds 300 thousand, including not only the positional but also the spectral and photometric observations. The pilot version of JDA includes only positional observations (<http://ukrvo.org/science/index.php?b1&2>).

By the current moment, JDA database contains more than 38 thousand records and more than 6 thousand digitized images from glass collections of Main astronomical observatory NAS of Ukraine (MAO NASU), Scientific-Research Institute “Mykolaiv Astronomical Observatory” (SRI MAO), astronomical observatories of T. Shevchenko Kyiv national university (AO KNU), I. Franko Lviv national university (AO LNU) and I. Mechnikov Odessa national university (AO ONU). Among them are:

- 26 thousand records of astronegatives' metadata and more than 6000 digital images of MAO NASU glass collection (GPA);
- 4 000 records of plates' metadata and more than 1 000 digital images (from 4 000 digitized ones) of AO

LNU glass collection;

- 8500 records of plates' metadata of SRI MAO glass collection (without images, which are available on the VO page of the official website of SRI MAO, the database obtained by the mutual exchange of information between MAO NASU and SRI MAO);
- metadata of 24 partially filled observational archives of AO KNU glass collection with digitized images of more than 1 000 individual plates selected for the solution of current scientific problems;
- 300 records and 300 digitized images of selected plates of AO ONU glass collection (out of 120 thousand plates).

MAO NASU digital archive (GPA)

GPA comprises data of about 26 thousand of direct photographic plates, obtained with 14 instruments in 9 observational sites, having plate scales varying from 20 to 412 arcsec per mm, exposition duration from 10 second up to 1.5 hour with a number of expositions from 1 to 10 and the different structure of star images depending on observational method.

GPA operates under the control of server software DBGPA V2.0 and is accessible via web browsers on the search pages of UkrVO JDA (<http://gua.db.ukr-vo.org/>).

SEARCH PARAMETERS
To select data fill at least one of search parameters, please

SEARCH in anywhere OR for INSTRUMENT

Center, geometry and dimensions of the field: RA h: m: s:
DEC d: m: s:

Geometry of the field: round radius/half-diagonal/width: units: deg of arc

Date or period: start year: month: day:
finish year: month: day:

Exposition and color: maximum exposure low limit: min. of time color system: any

select only available plates

SELECT...

Figure 1: The search interface of JDA.

Digitizing of the archive started in 2008 on the Microtek ScanMaker 9800XL TMA flatbed scanner, continued in 2010 on the Epson Expression 10000XL and runs in two modes. In the first one we obtain images with a high level of resolution in two positions for plates of satisfactory quality (visually estimated) used in the current research. Images are obtained in 16-bit grey range with the resolution 1200 dpi. Original files are stored in TIFF format. Linear dimensions of images are 13 thousand pixels (30x30 cm) on both sides. The file size is about 380 Mb.

Currently, about 3 thousand plates of FON program and more than 2 thousand plates of other observational programs are scanned in two positions. The second scan mode - preview image in 8-bit gray range with the resolution 1200 dpi, stored in JPG format. Linear dimensions of images are up to 1500 pixels on the larger side. At the moment, in this mode more than 1 thousand plates are scanned.

In addition to positional observations, GPA archive comprises about 50 thousand spectral plates. This collection has not yet systematized and cataloged and is waiting for its researchers. To make a decision, if it is possible to use these plates for research purposes, the scanning of the spectral collection with the observations of variables such as R Corona Borealis began and the first attempts of digitized images' processing have been made (<http://ukr-vo.org/spectral/>, Fig.2).

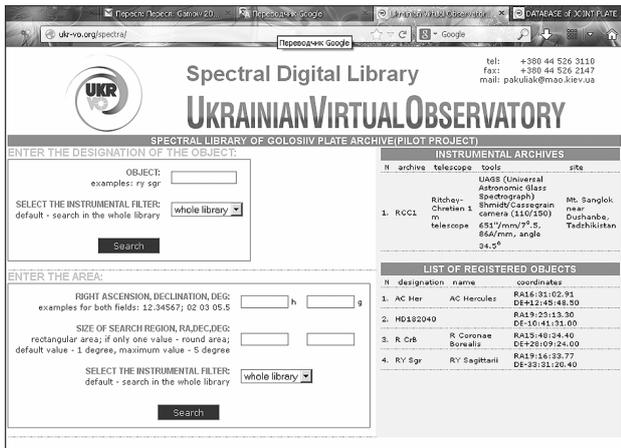


Figure 2: The interface of Spectral Digital Library, currently created on the UkrVO site.

AO LNU series of plates

Digital archive of AO LNU consists of direct images taken in a period 1939-1976 (a few plates are attributed since 1936). This archive contains about 8 thousand photographic plates, among them there are more than six thousands of direct northern sky area plates (mostly of wide-field). Observational programs concerned the search and study of variable stars by means of multicolor photometry, photographic photometry of circumpolar stars, novae stars, selected areas, occultations of stars by the Moon, Solar System bodies, and lunar eclipses. This almost 40 year coverage is a unique resource for studying of given objects. Instruments used: the camera with Zeiss lens triplet (D /F= 100/500 mm), Mertz refractor, astronomic camera (D/F=140/700 mm) and the Zeiss

refractor (D/F = 130/2400 mm). Part of the collection had never been processed at all or processed only partially. The complexity of data digitizing results from the fact that the most of the observational record books are in Polish and require decoding. Plates with emulsions of 15 sorts were used.

For now metadata of 4100 plates of AO LNU collection have been included into JDA (<http://gua.db.ukr-vo.org/createlist.php?aid=LAO010>) and more than 300 are ready to being added. At the moment, 3120 plates are digitized: among them there are 497 plates of historic interest as they were obtained in the first half of 20th century.

Historic plates are presented not only on the general search web pages of the JDA. It was decided to organize them into the historical online exposure on the UkrVO site (<http://ukr-vo.org/history/index.php?b2&4>). Also, these expositions are interesting from the point of view of educational historical and astronomical purposes (Fig.3).

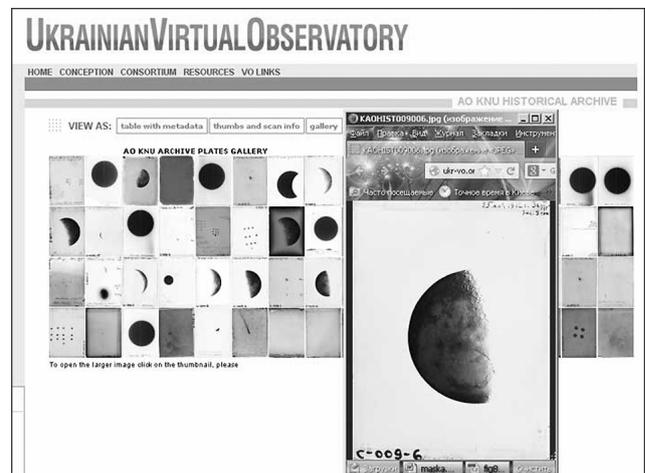


Figure 3: The example of historical exposition of photographic plates on web pages of UkrVO.

Glass collection of AO ONU

The archive contains about 100 thousand plates. The so called “old collection” contains 20 thousand plates, obtained since 1909, including the collection of Simeiz (Crimea) observatory. The other part of the archive is taken since 1957 and includes more than 80 thousand plates obtained in Odessa on the Mayaki observation station. Greater part of the collection consists of direct photos in photographic light. The instruments of the “old collection” were the long focus photographic camera – “large astrograph” – on the Cooke refractor with the aperture 165 mm; it was replaced with “small astrograph” equipped with 2 cameras and then three short-focus camera astrograph.

Observations were conducted using plates with "Ilford", "Agfa Astro", "Izoorto“ emulsions with yellow, red filters or without filter. The registered stellar magnitude was 13.5. The exposure time was from 0.5 to 3 hours.

Digitizing of the collection is selective, based on the computer facilities of MAO NASU since the observatory has no its own capabilities for the organization of this

process. To date, JDA includes metadata and digitized images of 300 plates. Scans were obtained by the Epson Expression 10000XL scanner. Pre-processing of digital images in the software MIDAS / ROMAFOT, made in the MAO NASU, showed that the evaluation of object centers and photometric characteristics of objects provides a standard positional and photometric accuracy of photographic observations and plates can be used for further research.

These plates form two observational archives - JDA components: CRI012A and CRI012B. Access to data and digitized images of plates is through search interface UkrVO JDA (<http://gua.db.ukr-vo.org/createlist.php?aid=CRI012A>). Fig.4 shows the results of joint query to JDA sent from search interface, which display data from all archives, included into JDA.

Glass archives of AO KNU

According to preliminary estimates the collection of astronegatives has about 20 thousand plates, obtained in 1898-1996. To date, about a quarter of plates is cataloged and classified. 65% of the collection are glass plates, and the rest includes large-format films. The observations are divided into approximately 200 series, which corresponds to 200 JDA components. To date, 24 metadata files are organized and replenished.

Most of the plates have dimensions of 13 x 18, 13 x 13 and 16 x 16 cm, the maximum size of plates - 30 x 30 cm, the minimum one 6 x 9 cm. The collection includes some amount of images obtained as the contact imprints, which requires further analysis of digitized images for the maximum possible precision they can provide. Pre-processing of digital images from the collections of AO KNU showed positional accuracy of 0.1 sec in both coordinates and photometric accuracy of 0.07^m.

Images	map	Archive ID	RA Meaning	DEC Meaning	Date	Expos. in	Dimensions	Instrum.	Object	Place of Storage
		MYK012 002591	7 39 48	+24 17 0	751154	5	20x20	ZZA	Interamnia	Available in Mykola
		KAO070A165002	7 38 0	0 11 0	750206	0.5	13x13	AZT8	433 Eros	upon request
		MYK012 009566	7 36 18	+13 2 0	660212	5	20x20	ZZA	Laetitia	Available in Mykola
		KAO070A165003	7 37 0	3 30 0	750211	0.5	13x13	AZT8	433 Eros	upon request
		GUA040C003367	7 37 47	+11 6 35	750203	3	24x24	DLA	433 Eros	sh.342 box110
		GUA040C003368	7 37 47	+11 6 35	750203	4	24x24	DLA	433 Eros	sh.342 box110
		MYK012 003307	7 37 48	+21 52 0	753226	2	20x20	ZZA	Vesta	Available in Mykola
		GUA040C001654	7 37 51	+25 44 37	530329	6.4	24x24	DLA	192 Nausikaa	sh.341 box75
		GUA040C001578	7 37 6	+0 34 16	791226	3	30x30	DWA	(3) Juno	sh.10 box71
		GUA040C001588	7 37 6	+0 34 16	791226	3	30x30	DWA	(3) Juno	sh.10 box72
		KAO070A165004	7 38 0	0 13 0	750215	0.5	13x13	AZT8	433 Eros	upon request
		MYK012 006362	18 7 6	-3 48 0	839519	5	24x24	ZZA	Hebe	Available in Mykola
		CR012A010825	18 8 0	-7 0 0	520620	45	13x18	ZDAO		upon request
		CR012B010826	18 8 0	-7 0 0	520620	45	13x18	ZDAO		upon request
		MYK012 006398	18 8 12	-18 8 0	830706	5	24x24	ZZA	Herodina	Available in Mykola
		MYK012 006153	18 9 24	-4 49 0	620654	5	24x24	ZZA	Juno	Available in Mykola
		LAO010 033482	19 0 0	-15 0 0	560705	30	13x18	Zeiss50/10	45 Eugenia	Available in the AO
		LAO010 033388	19 0 0	-5 30 0	560707	30	13x18	Zeiss50/10	3 Juno	Available in the AO
		LAO010 033491	19 0 0	-5 0 0	560705	30	13x18	Zeiss50/10	3 Juno	Available in the AO
		MYK012 008770	19 0 0	+20 0 0	970709	5	9x24	ZZA	Pallas	Available in Mykola
		LAO010 033387	19 0 0	-15 0 0						in the AO
		LAO010 033428	19 0 0	-15 0 0						in the AO
		LAO010 033477	19 0 0	-15 0 0						in the AO
		LAO010 033369	19 0 0	-14 0 0						in the AO
		GUA040C001587B	7 37 6							in the AO
		GUA040D001588	7 37 6							in the AO
		KAO070A165004	7 38 0							in the AO
		MYK012 006362	18 7 6							in the AO
		CR012A010825	18 8 0							in the AO
		CR012B010826	18 8 0							in the AO
		MYK012 006398	18 8 12							in the AO
		MYK012 006153	18 9 24							in the AO
		LAO010 033482	19 0 0							in the AO

Figure 4: Results of joint data search in JDA.

Currently database recorded metadata of about 1 thousand plates. Access to data is organized via the UkrVO JDA search interface (Fig.1,4).

Until recently, digitizing of the collection was conducted sporadically, mostly the plates with the bodies of the Solar System (Saturn, Jupiter, Pluto and their satellites), as well as plates of historical significance. The latter is similar to AO LNU historical part of the collection and is presented also as separate historical online exposition on the UkrVO site (Fig.3) (<http://ukr-vo.org/history/index.php?b1&4>).

Currently under contract with UAA the systematic digitizing of AO KNU plates and their linking to a database began. Digitizing is made on the Microtek ScanMaker 9800XL TMA scanner of MAO NASU.

Common problems of archival work

Large volumes of work require more resources, both technical, financial and human. The digitizing of early photographic observational archives is facing serious difficulties.

On the one side, we experience the lack of scanning and computer facilities in most of the small observatories as well as a staff enough to handle the vast collections. Another problem is the improper storage places of glass collections that create the risk of fatal collection damage before the collection is being totally digitized. As a result, we face the necessity of essential financial input without explicit and quick response.

On the other side, there is a low rate of digitizing with flatbed scanners: the process is stretching in time for years and gives way to organize poorly. In addition, there is the lack of distinctive scientific tasks with immediate scientific output, and, as a result, we have the decline of interest (that means – funds) in projects of such types.

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