

BULGARIAN-SERBIAN COLLABORATION IN THE ASTRONOMICAL WIDE-FIELD PLATE ARCHIVING

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Abstract. The wide-field plates are the basic source for information on the astronomical objects back in time. Their archiving in the context of repeated use for different tasks requires cataloging and storage of plate information in digitized form. We consider here the status of archiving of the wide-field plate astronomical observations in Serbia done in collaboration with the team of the Wide-Field Plate Database created in Sofia (Bulgaria). The question of easy access to the plate information is very important. The undertaken plate digitization with flatbed scanners with making previews for quick plate visualization and real scans with good resolution is based on change of ideas and experience between the Bulgarian and Serbian astronomers.

1. INTRODUCTION

Today there are more than 220 000 wide-field plates stored in the different astronomical institutions. These plates, which were the basis of many astronomical discoveries, are today the only source for seeing back in time interesting astronomical objects. The plates have to be archived, which include good storage providing a suitable temperature and humidity free conditions, an inventory of the plate collection, cataloguing, quick access to the information for plates and to good quality digital plate data.

In the Institute of Astronomy, Bulgarian Academy of Sciences, the work on enlargement of the Wide-Field Plate Database (<http://www.skyarchive.org>, WFPDB) requires collaboration with many astronomical institutions. Informal collaboration in the wide-field plate archiving between Astronomical Observatory Belgrade and the team of the WFPDB has existed since 1999. In 2004 a project titled *DEVELOPMENT AND APPLICATION OF ASTRONOMICAL DATABASES* in the frames of the bilateral academic cooperation between Astronomical Observatory

Belgrade and Space Research Institute, Bulgarian Academy of Sciences (that time a base institution of the WFPDB project) was improved for the period 2004 – 2006. Now the new project between Astronomical Observatory Belgrade and Institute of Astronomy, Bulgarian Academy of Sciences, running for a period 2007 – 2009, continues the work on the Belgrade observatory plates. The plates (with total number 14 500) have been accumulated in the frames of the observing programmes: Minor planets tracking, Search for new objects (33 new minor planets), Observations of comets, Observations of the Moon, Major planets and their satellites, Passage of Mercury, Lunar occultations, Variable stars, Double stars, Stellar clusters.

2. PROJECT WORKING PROGRAMME

The working programme of the current bilateral project includes:

- Cataloguing of the Belgrade wide-field plate archives, i.e. preparation of computer-readable versions in the WFPDB standard format and inclusion in the WFPDB and the BELDATA* with online access to the descriptive plate information;
- Plate digitization with estimation of the quality of the digitization data, linkage of the scanned plate images (plate previews – with minimal resolution for quick plate visualisation and quick online access, and real scans – photometric or astrometric scans with optimal big resolution) to WFPDB and BELDATA and online access;
- Plate processing;
- Application of archived plates for different astronomical tasks;
- Exchange of experience in development and application of astronomical databases (WFPDB and BELDATA);
- Organization of mirror sites of the databases.

* BELDATA (Belgrade Astronomical Database) comprises the Stark broadening parameters obtained mainly by the Belgrade Group of Astrophysical Spectroscopy; spectra of active galaxies, observed or reduced by the Belgrade astronomers; stellar catalogues composed in Belgrade; abstracts of papers (and later complete papers) published in Belgrade Astronomical Observatory.

The main priority in the working programme has the preparation of computer-readable versions of the Belgrade plate archives in the WFPDB format, as well as their inclusion in the WFPDB and the BELDATA. The following-up analysis of the plate catalogues based on the data retrieval from the WFPDB will provide the key to the plate repeated usage.

2. INVENTORY OF THE BELGRADE PLATE COLLECTION

The results from the up-dated inventory of the Belgrade wide-field plate collection and the present status of the archiving are shown in Table 1 and Table 2: three small telescopes with the identifiers BEL012, BEL016A and BEL016B in the WFPDB, produced 14500 plates in the period 1936 – 1996 and the archives are still in table (T) form.

Table 1. Belgrade telescopes produced wide-field plates.

WFPDB Identifier	Tel. Orig. Name	Aperture (m)	Focal Length (m)	Scale "/mm	Tel. Type	Field Size (deg)	Years of Operation
BEL012	Ascania Rfr	0.12	1.00	206	Rfr	7.0	1972-1996
BEL016A	Zeiss Rfr	0.16	0.80	258	Cam	11.5	1936-1985
BEL016B	Zeiss Ast	0.16	0.80	258	Cam	11.5	1936-1941

Table 2. WFPDB Belgrade archives.

WFPDB Identifier	Years of Operation	Plate Number	Archive Type	Astronomer in Duty
BEL012	1972-1996	4000	T	V. Protić-Benišek
BEL016A	1936-1985	10000	T	V. Protić-Benišek
BEL016B	1936-1941	500	T	V. Protić-Benišek

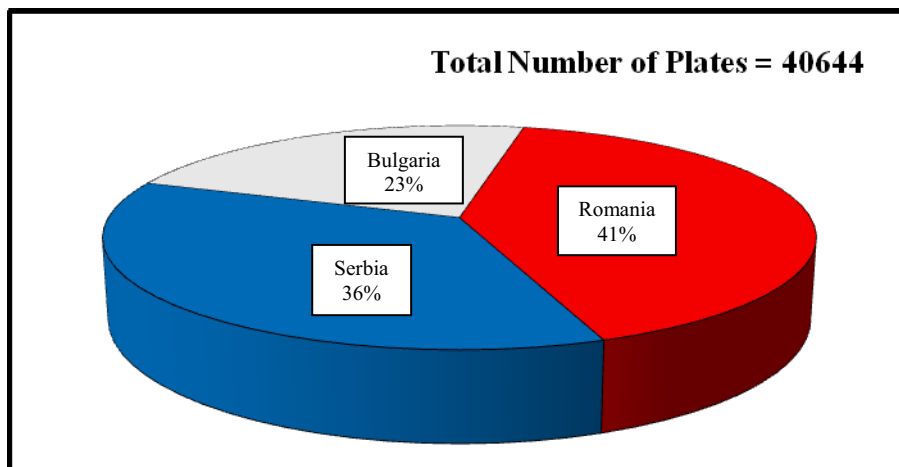


Figure 1: Balkan plate distribution.

Table 3. Balkan wide-field plates.

Country	Number of Plates
Romania	16600
Serbia	14500
Bulgaria	9544

In order to compare the contents of the plate collections of the Balkan countries (looking for regional collaboration) we extracted Table 3 from the WFPDB - Catalogue of Wide-Field Plate Archives (CWFPAs, Tsvetkova and Tsvetkov, 2005). The total number of all Balkan plates (the other Balkan astronomical observatories do not possess such plate collections) is 40644 (for the status before 2005 see Tsvetkova et al., 2005). Fig. 1 presents the plate distribution in percentage of this number.

3. CATALOGUING AND PLATE DIGITIZATION

The first information for the Belgrade plate archives was included in the CWFPAs (version August 2000) in the beginning of the collaboration. An online access to this information for all the astronomical community is provided through the WFPDB updated version in Sofia Sky Archive Data Center (SSADC, <http://www.skyarchive.org>).

A full inventory of the Belgrade wide-field plate collection is made, but up to the moment the computer-readable versions of the Belgrade plate archives are not ready.

The plate digitization and the systematic plate scanning are another important step in the wide-field plate archiving. The main requirements to the present-to-day scanners have to be a good compromise between providing astrometric and photometric accuracy while generating archival quality digital data and high speed of scanning. In SSADC except the PDS1010plus microdensitometer with possibility for high precision there is at disposal a flatbed scanner Epson Expression 1640XL with high speed (Scanning Platform: 310x437 mm; Resolution: 1600x3200dpi, Duration of scan: 5min for 16x16 cm plate; Plate Storage: in FITS format file with volume 120 MB). Some of the Belgrade plates obtained in the region of the Pleiades stellar cluster have been scanned with this scanner while waiting for own scanner (plates with original numbers 1936_10, 1936_53, 1953_26, 1955_10, 1977_131) and added to the archive of the scanned Pleiades plates (Pleiades Plate Database), aiming to reveal the long-term behaviour of some Pleiades stars.

Since 2007 in Belgrade Observatory a flatbed scanner EPSON PERFECTION V700 PHOTO is at disposal (Scanning Platform: 216x297mm; Resolution: up to 6400 dpi, Duration of scan: 6 min for 9x5 cm plate - 2 min for prescan and 4 min for real scan; Plate Storage: in FITS format file with volume about 30 MB. The preview images are taken with 600 dpi in JPEG format, the real scans - 2400 dpi in FITS format of the output file.

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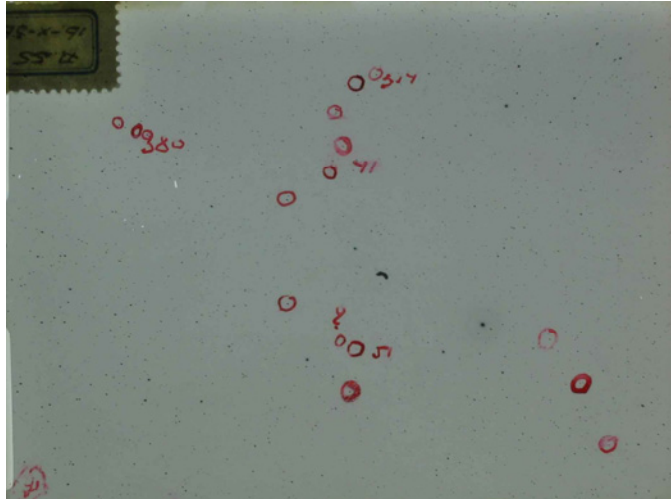


Figure 2: Plate No. 77.55 preview with the image of minor planet Serbia.

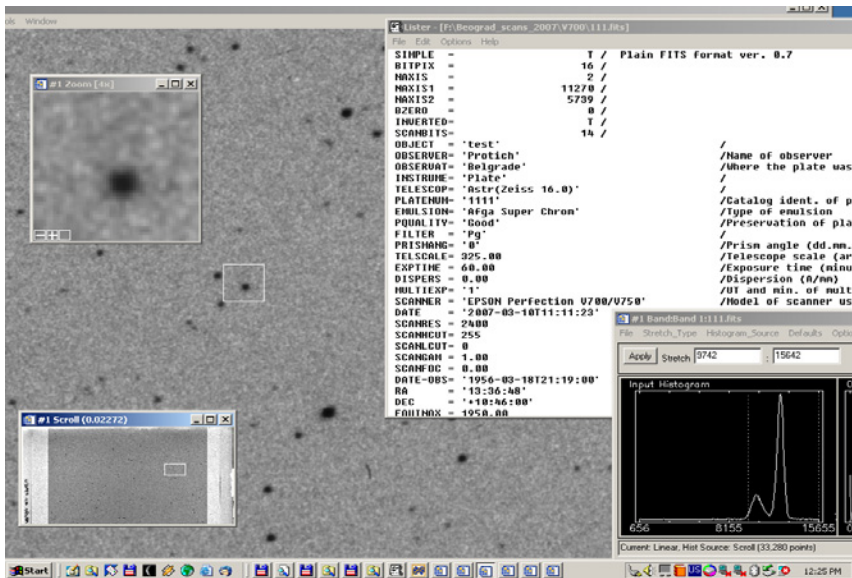


Figure 3: Composed images of scanned plate, with different zoom, FITS header and histogram of the scanning.

In Fig. 2 the preview image (in JPG format with volume about 1-2MB) done by digital Canon camera and light table, of the plate No. 77.55 from October 16, 1936 containing the image of minor planet Serbia, is present. This example aims to give an answer of the question why is important to make plate preview before real scanning. Making the preview images with minimal resolution (even with dig-

ital camera) stores the important marks of the observer (as is in the present example) and provides quick plate visualisation and quick online access.

As an example of real scan – photometric or astrometric one, done by the flat-bed scanner EPSON PERFECTION V700 PHOTO with resolution 2400 dpi in FITS format of the output file, in Fig. 3 the image of the scanned plate No. 1111 taken with the 16 cm astrograph Zeiss on March 18, 1956 is given. The preparation of digitized archives of selected Belgrade plates (e.g. containing images of the Pleiades stellar cluster, of minor planets and comets, etc.) as well as the systematic plate scanning will give about 1.5 TB scan data as a rough estimation. The systematic plate digitization will be done in the framework of the Virtual Observatory (a project titled Serbian Virtual Observatory is submitted in February 2008).

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