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Golosiiv DWA Plate Catalogues Presented in the WFPDB

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Abstract.

6110 plates obtained with the 0.40 m Double Wide-angle Astrograph (DWA) with focal length of 2 m and plate scale 103.16 arcsec/mm of the Main Astronomical Observatory (MAO) of the National Academy of Sciences of Ukraine in Golosiiv (Kyiv) have been included recently in the Wide-Field Plate Database (WFPDB). These DWA plate catalogues can be found on-line with the WFPDB identifiers: GUA040C and GUA040D. The plates were obtained in the period 1976–1998, according to different observational programmes (FON, MEGA, selection of reference stars, minor planets observations, comet investigations, artificial satellites observations). These plates were the basis for determination of positions, proper motions and photometric data for more than 2,000,000 stars from the FON Astrographic Catalogue (FONAC), as well as for determination of the absolute proper motions for more than 14,000 stars. The plates with limiting photographic magnitudes up to $16^m.2$ can be now re-used for different astronomical purposes.

1 Introduction

About 10,000 plates are obtained with the Double Wide-angle Astrograph (DWA, $D = 0.40$ m; $F = 2$ m; Scale = 103.16 arcsec/mm) of the Main Astronomical Observatory of the National Academy of Sciences of Ukraine in Golosiiv (Kyiv). The plates are distributed in three archives – for the both tubes of the double astrograph (respectively with 4276 and 1834 plates) and for the special camera for observations of geostationary satellites (with more than 3600 plates) mounted on the DWA.

The plates obtained with the both DWA tubes with limit stellar magnitude up to $16^m.2$ (pg) were used for creation of the Photographic Survey of the Northern Sky (FON) and determination of positions, proper motions and photometric

data for more than 2,000,000 stars (FONAC) using as first epoch the well known Carte du Ciel Astrographic Catalogue (AC) [1,2]. For the measurements the best 1600 plates were selected. Using the DWA plates a general catalogue of absolute proper motions for more than 14,000 stars was created [3]. The observing programmes as usually make a specified identification of every archive – method used, exposure multiplicity, emulsions, plate quality, *etc.* in view of repeated use of the plates. That is why the main executed observing programmes with the Double wide-angle astrograph are shortly described, designated as follow:

- DWA: Selection of the kinematically homogeneous group of reference stars and proper motion investigations, as well as calibration of stellar magnitudes for compilation of a general catalogue; Observations of planets and asteroids.
- FON: Creation of Photographic Survey of the Northern Sky (Fotografichny Ohlyad Neba) with declination from $+90^\circ$ up to -2° with the collaboration of observatories from the former Soviet Union and determination of positions, proper motions and photometric data for stars of Astrographic Catalogue (AC), which is a part of the Carte du Ciel project.
- MEGA: Investigation of the kinematics and the structure in the main meridian section of the Galaxy, construction of catalogues of proper motions of stars with respect to more than 200 galaxies in selected fields, their positions, stellar magnitudes in UBVR and Vilnyus systems, parameters of stellar classification: absolute stellar magnitudes, effective temperatures, metallicities of all stars to 12^m in 47 areas of the sky.
- SIZ: a programme for comet investigations, initiated by Yu.V. Sizonenko.
- SAT: Observations of the geostationary satellites in the period 1979–2005 with the both tubes of the DWA, as well as with a special camera giving a field of $6.5 \times 6.5^\circ$ (the plate catalogue with WFPDB identifier GUA040E containing information about more than 3600 plates is in process of preparation now).

In order to enable a possible re-usage of the plates for future astrometric or photometric tasks we present here the first two DWA plate catalogues incorporated in the WFPDB.

2 Incorporation of the DWA Plate Catalogues in the WFPDB

The both DWA plate catalogues have been included into the Wide-Field Plate Database (WFPDB, http://www.skyarchive.org/search/) and therefore available on-line since April 2006 with archives (or instrument) identifiers GUA040C and GUA040D. In the WFPDB search page the catalogues plates can be found with

the WFPDB observatory identifier GUA, Instrument aperture 0.40 cm, Instrument aperture suffix "C" or "D" (respectively for both tubes of the double astrograph) plus the original plate number.

The original plate catalogues have been prepared in the accepted WFPDB format. The main problem aroused out of the existence of different log-books for the different observing programmes, where very often the same original plate number could be met even several times. According to the WFPDB rule a suffix (A, B, C, and so on) was assigned to the original plate number. In an occasion of existing more plates with the same original number the suffix was assigned to the original plate number in an order: "A" for the FON plates, "B" for the DWA plates, "C" for the SIZ plates, "D" for the MEGA plates, "E" for the SAT plates.

The work of incorporation of the plate catalogues in the WFPDB revealed some mistakes (in coordinates and dates, misprints of different origin as in object names, observer's names, emulsions or filters, notes, *etc.*) either of the observers or made during the preparing of the computer-readable catalogue. These mistakes are corrected in the present WFPDB plate catalogues versions, which make them different from the original ones stored in the MAO, National Academy of Sciences of Ukraine in Golosiiv (Kyiv).

The WFPDB-Sofia Search Page for the archives with identifiers GUA040C or GUA040D gives more details for the location of the archives, for the observatory, for the parameters of the telescope, and the period of its operation, the coordinates of the plate center in epoch 2000.0, the date and beginning of the observation in UT, object name and type, method of observation, number of exposures and their duration, type of emulsion, filter and spectral band, the size of the plate, the quality of the plate, some notes with specific contains, the name of the observer, the place of plate storage (availability) and the status of plate digitization (at the moment the digitization is just started with MICROTEK ScanMaker 9800 XL with Transparent Media Adapter-1600 with resolution 1200 dpi), as well as the name of astronomer in charge for the archive.

3 Analysis of the Plate Catalogues

The analysis of the both DWA plate catalogues is based on the data retrieval from the WFPDB. That is why there are some differences concerning the number of plates, period of observations and object type distribution, given in the descriptions of the DWA archives earlier in [4, 5].

The GUA040C and GUA040D catalogues comprise the information for 4,276 plates, obtained in the period 1976–1998 and respectively 1,834 plates, obtained in the period 1976–1997. Their all-sky distributions (of the plate centers) taken from the WFPDB – Sofia Search Page are given in Figures 1,2. A sinusoidal strip connected with minor planets observations in the ecliptic plane can be clearly noticed for the both archives. The time distribution of the plates is given in

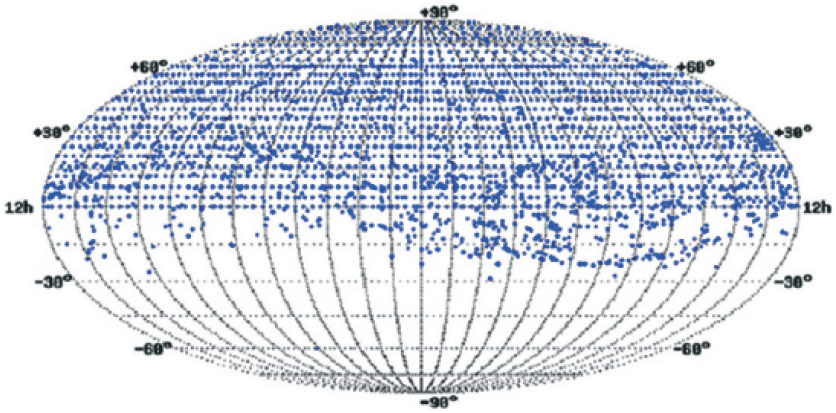

Figure 1. All-sky distribution of the DWA040C plate centers.

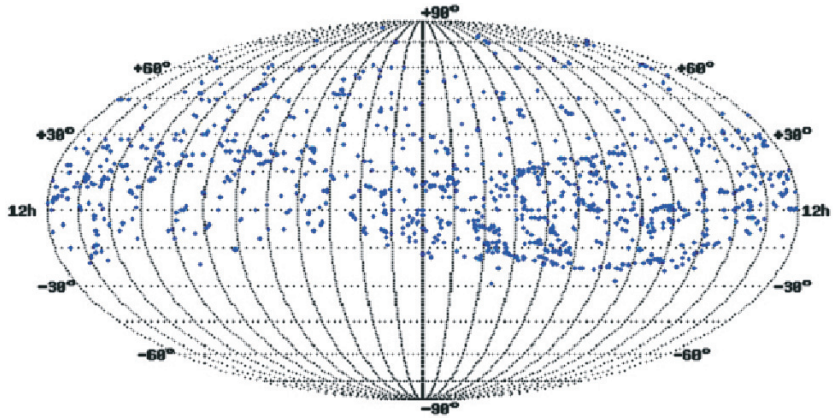

Figure 2. All-sky distribution of the DWA040D plate centers.

Figure 3. For the GUA040C plate catalogue a maximum in the time distribution can be seen for the period 1984–1988, when 38.0% of all GUA040C plates were received. For the GUA040D the intensive period for observations is 1976–1987 (93.0% of all plates).

The distribution of the number of plates according to the observing programmes (Figure 4) shows that only GUA040C plates were practically used for the FON project. The GUA040D plates were obtained mainly according to the DWA programme. It is interesting to note that for MEGA only 90 GUA040C plates were obtained and only one GUA040D plate. The reason is that about one third of the FON fields, which were close to the main meridian of the Galaxy (within $\pm 20^{\circ}$) have been also used for MEGA.

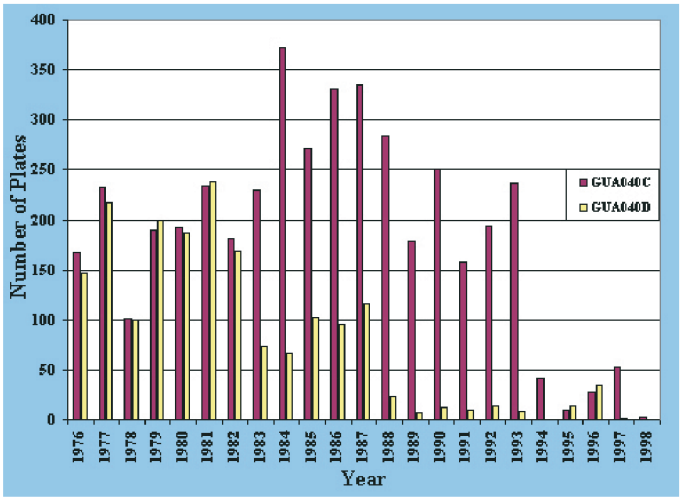

Figure 3. Time distribution of the GUA040C and GUA040D plates.

The type of the observed objects can be grouped for Planets, Minor Planets, Comets, Artificial Satellites, Fields, Galaxies, Stars, Star Clusters and Reference Stars (Figure 5). As a consequence of the main observing programmes there is a definitive maximum for "Fields". As a result of the minor planets observations 1063 plates altogether were obtained or 17.0% of all plates.

The multiexposure method was the main method of observation (Figure 6). Such

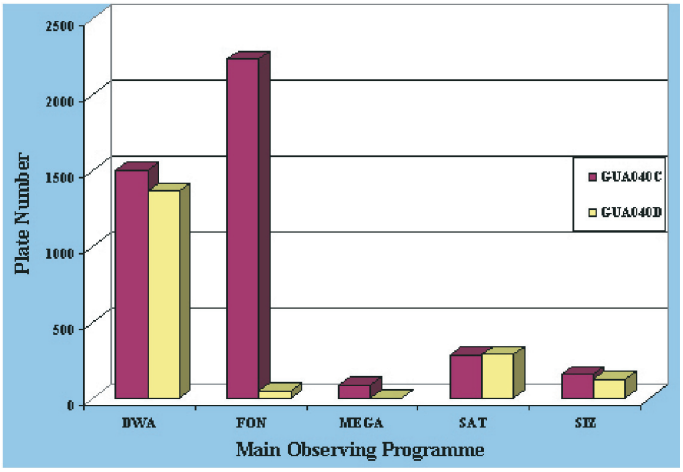

Figure 4. Plate number versus observing programme.

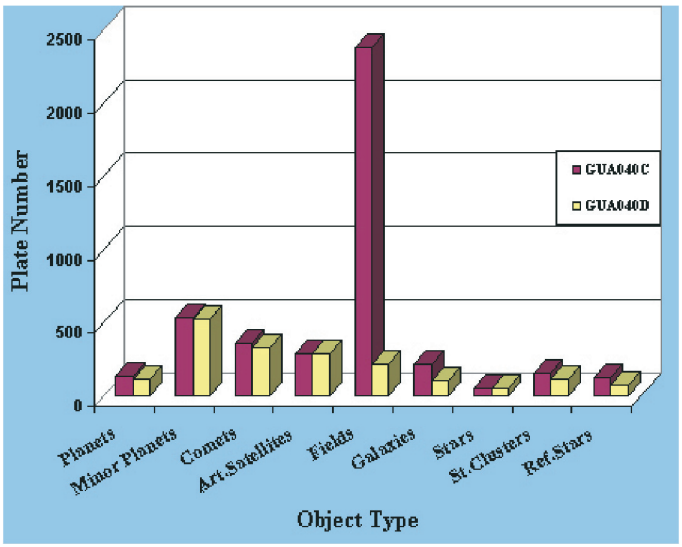

Figure 5. Plate number versus object type.

method was used for FON, MEGA, as well as DWA observing programmes. This is reflected also in the plate distribution versus exposure multiplicity in Figure 7, where the maximum can be explained with the two exposure plates

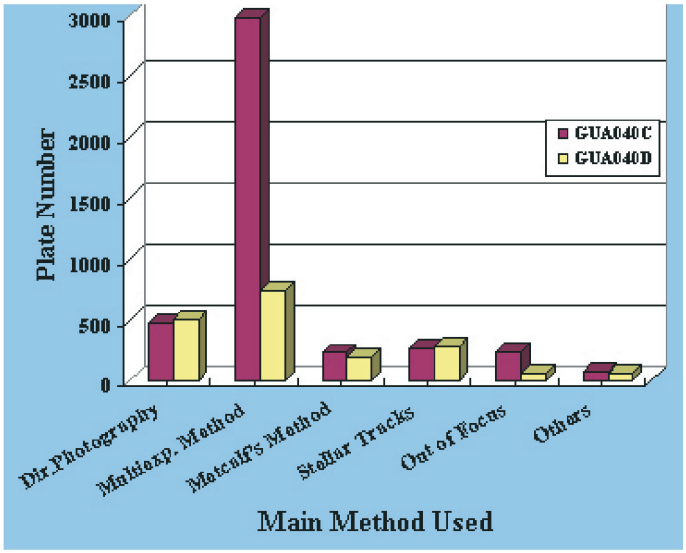

Figure 6. Plate number versus method used.

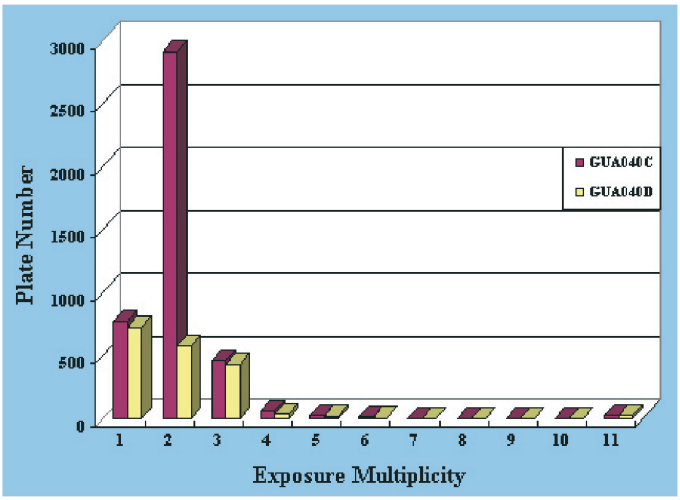

Figure 7. Plate number versus exposure multiplicity.

used for FON (mostly with short 40 sec exposure and longer one of 18 min). Concerning the exposure duration we have to note that as a rule the duration of the first exposure is included in the MainData file of the WFPDB. The duration of the rest existed exposures is given in the notes. So having in view the first exposure duration a distribution of the plate number with first exposures up to 5 min; from 5 min up to 10 min; and so on, is present in Figure 8. In this distribution only 35% of the GUA040C plates were received with first exposure

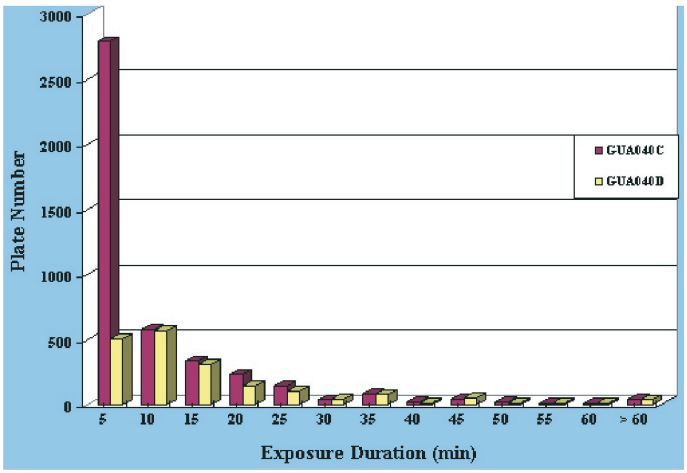

Figure 8. Plate number versus exposure duration.

longer than 5 min (the first exposure for the FON project has a duration of order 0.6–0.8 min). In the same distribution for GUA040D catalogue this part is 72.0% as a consequence of the fact that the most observable objects here were Minor Planets, Comets and Fields requiring longer exposures. The duration of the second and existed following exposures as a rule for the observing programmes FON and respectively MEGA are longer: in the time interval 13–23 min, mostly 18 min. For Minor Planets observations the second or following exposures have the same duration as the first exposure.

The DWA observations are very homogeneous concerning the used emulsions (Ilford, Kodak and ORWO) and filters. The distribution of the used emulsions for the GUA040C archive is Ilford (1.0%), Kodak (0.2%) and ORWO (98.8%) and for the GUA040D archive – Ilford (2.9%), Kodak (0.4%) and ORWO (96.7%). Most of the plates in the both archives were obtained without filter (for GUA040C – 98.2%; for GUA040D – 94.0%). As a result of the used emulsions and filters m(pg) stellar magnitude is mostly realized.

An important question concerning the plate digitization is their size. The GUA040C plates are with sizes from 10×12 cm, 12×18 cm, 20×20 cm, 22×22 cm (about 1%); 24×24 cm (13.5%); 30×30 cm (85.5%). Respectively for GUA040D archive: for plate size 10×10 cm, 10×12 cm, 10×18 cm, 12×12 cm, 13×18 cm (1.6%); 24×24 cm (2.2%); 30×30 cm (96.2%).

For the GUA040C plate catalogue 327 plates were not found in the observatory vault. For Gua040D plate catalogue this number is 89.

The list of observers contains 36 names, but if we put the restriction for the number of plates obtained to be more than 100, the list will be shorten to 13 names only (Figure 9).

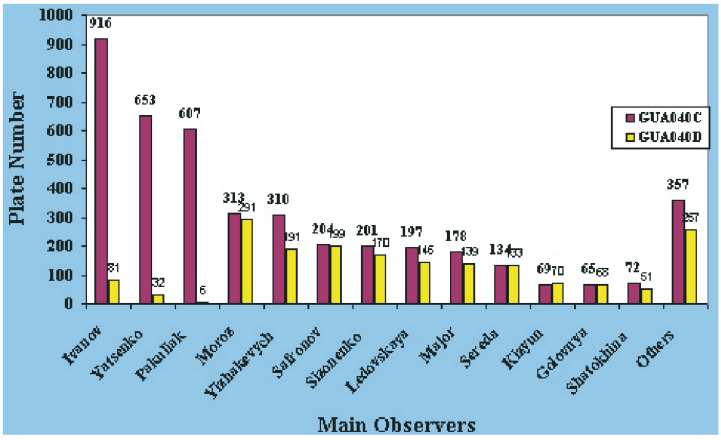

Figure 9. Observers obtained more than 100 plates.

4 Conclusions

The first step to future re-use of the DWA plate archives of the Main Astronomical Observatory of the National Academy of Sciences of Ukraine in Golosiiv, Kyiv, Ukraine (with WFPDB identifiers GUA040C and GUA040D) is made with the inclusion of the plate catalogues in the WFPDB giving on-line access to them. The next step to the DWA plates re-use on-line is their forthcoming digitization.

5 Acknowledgements

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