Stars from the GTSh10 catalogue in the Shajn’s Plan

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ABSTRACT

We examine objects from the GTSh10 catalogue among the studied stars as a part of implementing the Plan of Academician G.A. Shajn in order to replenish the database of photometric and spectral observations of red dwarfs. We consider a question concerning the cross-identification of data from the GTSh10 interactive version and the Shajn’s Plan catalogues, as well as an access to the archive of photographic observations. The article is illustrated with examples of working with the obtained list by means of the Virtual Observatory in order to analyze the state of objects and/or to refine their photometric and spectral characteristics in the middle of the past century.

Key words: catalogues, archive observations

1 Introduction

The creation of the integrated structure of the database that constitutes the basis for the Crimean Astronomical Virtual Observatory (Shlyapnikov, 2007, 2013) implies the detection of relations in the accumulated observatory data. This involves original observations maintained in the ‘glass’ library and derived in the digital format, and the published results of studies, including those presented as catalogues.

In 2010 the GTSh10 catalogue was compiled containing 5535 objects, mostly red dwarfs of the lower part of the main sequence. A detailed description of this catalogue was given in Issue 1, Vol. 107 of the Izvestiya Krymskoșı Astrofizicheskoi Observatorii (Gershberg et al., 2011).

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Fourteen catalogues that contain information on magnitudes, color indices and spectral types of \( \sim 35000 \) stars have been obtained when implementing the project Plan of Academician G.A. Shajn (hereafter Shajn’s Plan) on a study of the Galaxy structure. These were published in 9 volumes of the Izvestiya Krymskoșı Astrofizicheskoi Observatorii between 1953 and 1963, in Vol. 7 of the Trudy Rizhskoi Astronomicheskoi Laboratorii in 1963 and in Vol. 136 of the Soobschenia GAISH in 1964 (Pronik, 2005). In 2007 there was started a converting of catalogues into the computer-readable format (Gorbunov, Shlyapnikov, 2017a, 2017b).

Observations carried out at the Crimean Astrophysical Observatory became the basis for the creation of the Shajn’s Plan catalogues. There were derived 800 direct images and 500 negatives with an objective prism. Taking into account a significant area of coverage on the celestial sphere along the Milky Way (more than 1300 square degrees), of special interest are variable stars, particularly those with irregular brightness variations, flare activity manifestations, as well as other peculiar objects. More detailed information on the observational archive, perspectives of its digitization and application to solve astrophysical tasks may be found in a series of publications (Bondar’, 2002; Bondar’ et al., 2006; Bondar’, Shlyapnikov, 2009; Gorbunov, Shlyapnikov, 2013; Pakuliak et al., 2014).

2 Identification of stars from GTSh10 in the Shajn’s Plan catalogues

Fig. 1 and Fig. 2 show that a significant number of stars from GTSh10 should be present both in catalogues and in the Shajn’s Plan negatives. Note that these catalogues commonly include photometry carried out in two bands and stellar spectral classification. Data of catalogues and possibility of independent brightness determination of stars from GTSh10 based on negatives allow us to estimate the object state at the moment of data acquisition.

The problems of interactive usage of catalogues developed based on Shajn’s Plan are considered in detail in one of the articles devoted to its converting into the digital format (Gorbunov, Shlyapnikov, 2017b).

To make a cross-identification of objects from GTSh10 and stars from the Shajn’s Plan catalogues, the interactive Aladin Sky Atlas was applied (Bonnarel et al., 2000). Table
Table 1.

| R.A Decl. No. | Name | mag | OF | R.A Decl. BD | Sp | B | B – V |
|---------------|------|-----|----|-------------|----|---|------|
| GTSh10 | GTSh10 | GTSh10 | SIMBAD | mgt | B58 | B58 | BD | B58 | B58 | B58 |
| 02 14 44.40 | +59 47 57.0 | 420 | V* V603 Cas | 11.18 B | M0.5 | F | 02 14 44.37 | +59 47 56.6 | +59 151 | F0 | 11.29 | – |
| 02 13 31.60 | +60 26 03.0 | 415 | V* V601 Cas | 11.71 B | – | F | 02 13 31.62 | +60 26 03.6 | +60 77 | G0 | 11.66 | – |
| 02 30 39.60 | +61 00 25.0 | 467 | V* V612 Cas | 12.50 B | M2 | F | 02 30 39.63 | +61 00 25.2 | +60 192 | K0 | 12.03 | – |
| 02 55 56.90 | +61 31 16.0 | 552 | HR 860 | 5.60 | F4/8 | – | 02 55 56.75 | +61 31 15.8 | +61 430 | E5 | (6.0) | – |
| 02 22 26.30 | +61 35 35.0 | 457 | V* V607 Cas | 12.10 B | M | F | 02 22 26.27 | +61 35 34.9 | +61 126 | B5 | 12.18 | 0.52 |
| 02 24 52.90 | +61 53 47.0 | 459 | V* V609 Cas | 12.30 B | M3 | F | 02 24 52.60 | +61 53 46.0 | +61 134 | K5 | 12.05 | – |

Fig. 1. Distribution on the celestial sphere of objects from the GTSh10 catalogue and the area of coverage by negatives acquired through the Shajn’s Plan (in the galactic coordinate system)

Fig. 2. Distribution on the celestial sphere of objects from the GTSh10 catalogue and the area of coverage by negatives acquired through the Shajn’s Plan (in the equatorial coordinate system)

Fig. 3. Pleiades region with stars from the GTSh10 catalogue and negatives contours from the archive
noting the image number in the archive. Hence, we selected negatives SC570202422 and SC560902424 (Fig. 4). The next step is a reduction of negatives with the program Sextractor (Bertin, Arnouts, 1996). The identified objects were calibrated in the system of the Tycho-2 catalogue (Hog et al., 2000) (Fig. 5). The linearization of characteristic curves has not been performed at this stage.

Note that during the reduction we used the zoomed-out images (a preview) available online. Therefore, it is irrational to make heavy demands on the photometric accuracy when estimating object brightness based on these negatives, above all since the size of stars in angular measure is about 1'; and in order to make a correct calibration of images it is required to perform a summation of object brightness near the calibrated one with such a diaphragm. Nonetheless, Fig. 6 shows good agreement between magnitudes $V$ from GTSh10 and those determined from the negative SC560902_42_4.

**4 Conclusions**

The considered procedure of searching for the objects from the GTSh10 catalogue based on the Shajn’s Plan data makes it possible to enlarge the CrAO database of photometric and spectral observations of red dwarfs. The possibility of operating with interactive applications of the International Virtual Observatory provides access to the world astronomical databases.

The Shajn’s Plan data are available at the website\(^1\) of the Crimean Astrophysical Observatory. To download the Shajn’s Plan archive observations using the interactive Aladin Sky Atlas, it is required to copy a link\(^2\) into Location of the program interface.

\(^1\) http://www.craocimea.ru/~aas/PROJECTs/SPPOSS/CrAVO_SPPOSS.html
\(^2\) http://www.craocimea.ru/~aas/PROJECTs/SPPOSS/Plates_Archive/SPPOSS.AJS
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