Discovery of new red stars with digitized plates of the μ Cephei ragion

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Abstract

The results of the spectral classification of 357 red stars observed in the Cepheus region are presented. 257 of the featured stars are included in the KP2001 catalogue. We found the remaining 100 red stars as a result of digitizing plates used in compiling the KP2001 catalog. All star data is taken from the *GAIA* DR3 database. These stars are most likely giants and supergiants. None of them were included in the catalog of variable stars. It has been suggested that further research may reveal variability in many of these.

Keywords: *red stars: variability*

1. Introduction

Stars M and C type or red stars play an important role in stellar evolution. They can be in various subsystems in the Galaxy. Studies of red stars are of great importance to interpret the stages of stellar development, as well as to understand the physics of the main sequence transitions - giant-supergiant-dwarf, as well as the detection of evolved stars of the late spectral class and their spectral studies. The observation material was obtained in 1970 with the 1-m Schmidt telescope of the Byurakan Observatory with $1^0.5$ and 4^0 prisms, covering the range $\alpha = 23^h 32^m.7$, $\delta = +67^0$.

2. Discovery of new red stars with digitized plates

We detected the red stars on the digitized plates using standard image analysis software (FITS VIEW, SAO IMAGE ds9 and Aladin v11.0). The spectral classification of red stars was carried out primarily using spectra obtained using a 4° objective prism. To determine the subtypes of stars, we used the TiO $\lambda\lambda$ 7054, 7589, 8300, 8432 Å and VO $\lambda\lambda$ 7400, 7900 Å absorption bands wich are the main classification criterion. Figure 1 shows examples of low-resolution spectral shapes for the newly discovered objects on the digitized Plate which are red stars.

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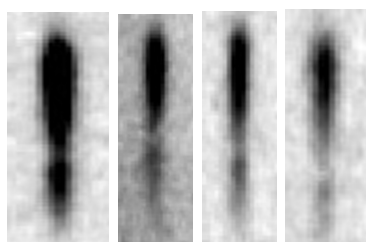
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Figure 1. Low-resolution spectral shapes for the newly discovered 4 objects on BAO Plate Archive.

Table 1. Gaia DR3 and 2MASS photometric data for the 10 new confermed red stars

| RAJ2000 "h:m:s"	RAJ2000 "d:m:s"	2MASS	J mag	H mag	K mag	G mag	BP-RP mag
23 11 30.16	+66 30 19.13	23113015+6630191	8.06	6.96	6.44	11.95	3.532
23 12 29.20	+66 05 13.08	23122918+6605130	9.27	8.12	7.71	13.10	3.623
23 12 48.20	+68 13 56.12	23124820+6813561	9.08	7.93	7.51	12.94	3.689
23 12 50.47	+66 48 13.95	23125043+6648139	8.87	7.65	7.22	12.87	3.743
23 13 23.45	+67 43 42.82	23132344+6743429	8.76	7.35	6.66	13.36	3.909
23 14 09.44	+66 30 19.54	23140942+6630195	8.92	7.69	7.22	13.11	4.252
23 14 38.67	+66 40 54.40	23143866+6640544	8.73	7.55	7.17	12.38	3.091
23 14 53.85	+67 25 00.47	23145385+6725004	7.73	6.58	6.24	11.29	3.085
23 14 55.93	+68 17 02.82	23113015+6630191	8.06	6.96	6.44	11.95	3.532
23 15 06.16	+67 38 30.71	23122918+6605130	9.27	8.12	7.71	13.10	3.623
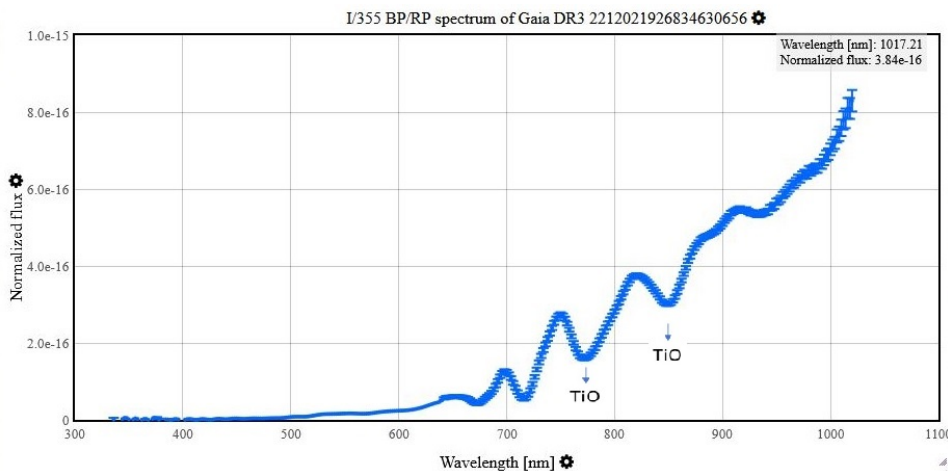
Figure 2. Gaia DR3 spectrum of the object Gaia DR3 2212021926834630656.

3. Gaia DR3 and 2MASS photometry

Table 1 presents the Gaia DR3 and 2MASS (Two Micron All-Sky Survey) JHKs photometric data for the 10 new red stars. We also used traditional color-color plots (J-H, H-K) to distinguish between the luminosity class of dwarfs and giants. The diagram clearly shows that most of the new objects are red giants and supergiants.

4. Gaia DR3 spectroscopy

All new objects were cross-matched with Gaia DR3 catalogue (CDS VizieR Catalogue I/355/gaiadr3) sources. Figure 2 presents Gaia DR3 low-resolution spectrum of the object Gaia DR3 2212021926834630656. Gaia low-resolution spectra are available at CDS ViziR data basa - I/355/spectra.

5. Summary

In the present work we found 100 red stars in a region of Cepheus with an area of about 17 deg^2 . We determined their spectral subtypes, which range from M0 to M10.

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