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Gaia18aak is a new SU UMa-type dwarf nova

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Abstract. We report the discovery of a new SU UMa-type dwarf nova, Gaia18aak/ AT2018C, based on its optical observations, which were performed at five observatories (Lisnyky/Kyiv, Terskol, CrAO, Mayaki/Odessa and Stará Lesná, Slovakia) with six small telescopes. The observational campaign started just after the alert was published by ESA Gaia, DPAC and the Photometric Science Alerts Team (http://gsaweb.ast.cam.ac.uk/alerts); the object was very intensely observed during the first month. After this there was organized a four-month monitoring in order to test outburst activity of the object.

We detected the 0.0647-d (or 0.0692-d) superhump period during five nights of the superoutburst. Furthermore, we found the only possible outburst during the subsequent 100 nights.

Key words: variable stars – CV's – GAIA

1. Introduction

Dwarf novae (DN) are a subclass of cataclysmic variables (CV), which are close binary systems and consist of a white dwarf (WD) and an old (K-L) spectral type dwarf. The old-type component fills its Roche lobe and its matter accretes onto the WD through the inner Lagrangian point, creating an accretion disk around the primary component (Warner, 1995). There are two special subclasses among DN: SU UMa-type and WZ Sge-type dwarf novae.

SU UMa-type dwarf novae produce two types of outbursts - normal outbursts with typical duration of 2-5 days and an amplitude of 2-3 mag and superoutbursts that have longer duration and a higher amplitude. The main difference of superotbursts from normal outbursts is the presence of light variability with periods that only by some percent differ from the orbital period - superhumps. Usually several normal outbursts occurred between two neighbor superoutbursts. The time between two superoutbursts is called a supercycle. A WZ Sge-type DN differs from an SU UMa-type DN by a longer supercycle that can last from several years to decades (Kato, 2015).

Gaia18aak (AT2018C) was discovered as a blue hostless transient on 2018-01-01 and reported on 2018-01-03 by Delgado et al. (2018) on behalf of the Gaia Alerts team. The alerting magnitude of the object was G = 16.48 with coordinates (ep=J2000) α = 04 12 01.22, δ = +76:00:57.31. On the images from 2017-12-20 the object was fainter than the limiting magnitude G = 21.5. We started to observe Gaia18aak from 2018-01-09 and detected variations with a period of about 0.068^d and an amplitude of 0.15^m (Simon et al., 2018). Later, on 2018-01-13 the Asiago Transient Classification Program (Tomasella et al., 2014) reported the spectroscopic classification of AT2018C (= Gaia18aak) (Tomasella et al., 2018) that gave them an opportunity to classify Gaia18aak as a cataclysmic variable.

We present the result of our monitoring of Gaia18aak in order to specify its classification.

2. Observations and data reduction

UBVRcIc photometry of Gaia18aak was carried out at six small telescopes at five observational sites (Lisnyky (Kyiv), Terskol, CrAO, Mayaki (Odessa) and Stará Lesná, Slovakia). We provided observations in *UBVRcIc*-bands for color estimation and in the integral light (marked as "Clear") for period estimation. Images obtained in unfiltered light are close to images obtained in the *Rc*-band. All frames were bias and dark subtracted and flat-fielded in the standard manner using MaxIm DL and V. Goranskij (http://www.vgoranskij.net/software/) WinFit packages. These packages were also used to measure the brightness of variable, comparison and check stars. As the reference star we used a star from APASS DR9 catalogue (Henden et al., 2016) with equatorial coordinates (ep=J2000) α = 04 12 53.78544, δ = +75 59 39.0336 and magnitudes B = $15^m.541$, V = $14^m.860$, r' = $14^m.671$, i' = $14^m.500$. In this work we present nightly and longterm variability in the R-band and no color analysis will be done. In case of absence of data in the R-band for several nights, data in integral light or in the I-band were taken.

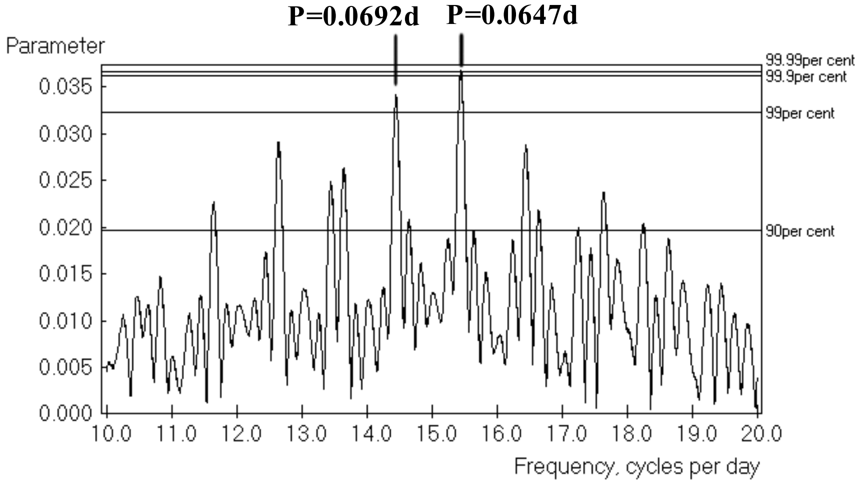

Figure 1. A five-night periodogram.

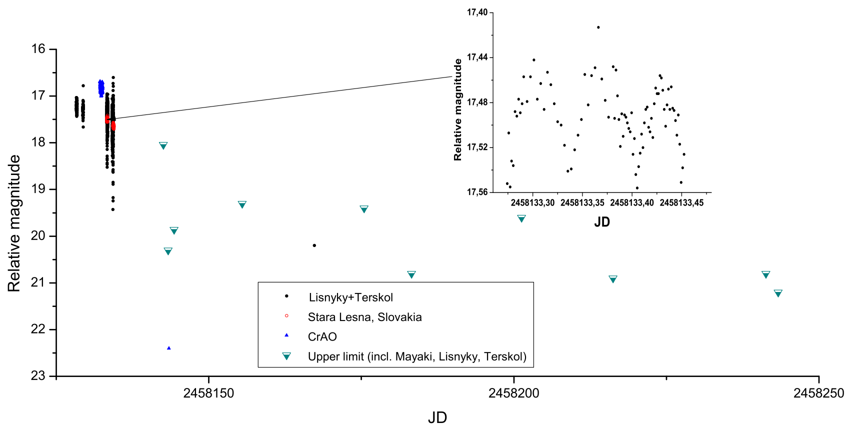

Figure 2. The light curve of Gaia18aak for the whole period of observations. *The inset*: Variability of Gaia18aak on January 14, 2018 (JD=2458133).

3. Results

All our data can be divided into two groups: during the superoutburst and after it. During the superoutburst we obtained data from five nights: 2018-01-09, 10, 13, 14 and 15. For all of these data we provided a periodogram analysis and obtained a period of 0.0647 days (or the aliased one 0.0692 d)(see Fig. 1). We should notice that this period is typical for SU UMa stars (Kato et al., 2009). The next data from 2018-01-24 showed that the object already was $m = 22^m.4$ in an unfiltered image. Also we should note that the latest observations from 2018-10-16 and 17 showed no sign of the object and the limiting magnitude on the images was $m = 22^m.3$. Given this fact, we can estimate the duration of the superoutburst to be less than 23 days with the amplitude higher than 6^m.

After the superoutburst on all images there were no Gaia18aak detected except one night on 2018-02-17 when the object reached $m = 20^m.2$. We suppose that on this date we detected an ordinary outburst. All the photometric data are presented in Fig. 2.

4. Conclusions

The periodogram analysis for the combined five nights yields the best period of 0.0647 d (or the aliased one 0.0692 d). The multi-site campaign confirmed our preliminary suggestion that GAIA 18aak is a new SU UMa-type dwarf nova.

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