

# Follow-up studies of Gaia transients at the Terskol Observatory

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**Abstract.** Since 2015, scientific activities at the Terskol Observatory have been aimed at optical follow-up of stellar objects and asteroids detected within the framework of the Gaia mission. Two years of successful research have yielded new data and findings in this field. Photometric observations of Gaia transients allowed us to reveal physical characteristics of a good few of them. Moreover, we detected positions of dozens of asteroids which were reported by the GBOT group. In this paper, some results obtained from observations of transients Gaia16bkf, Gaia16bkn, Gaia17asz and newly detected asteroids are presented.

**Keywords.** techniques: photometric, asteroids, stars: variables: other, Gaia transients

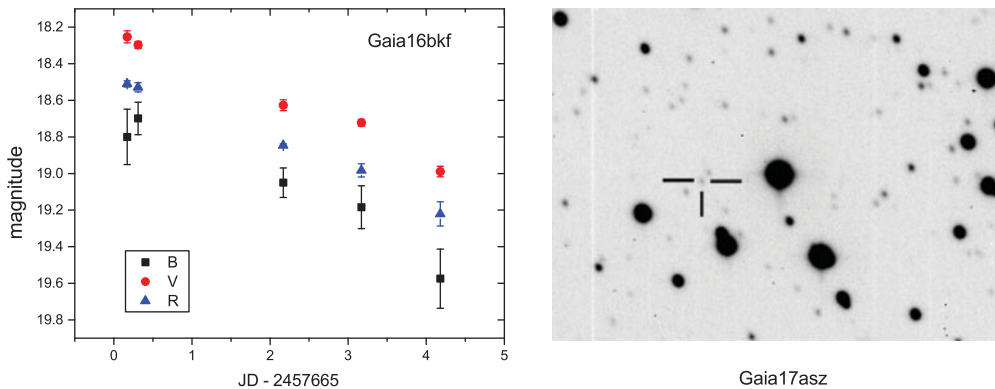
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## 1. Introduction

Facilities of the Terskol Observatory (the Northern Caucasus, 3100 m asl) have been heavily used for observations within the framework of the Gaia mission since 2015. The available telescopes Zeiss-2000 and Zeiss-600 provide good enough opportunities for long-term astrometric and photometric monitoring of stellar objects (SNe, CVs, YSOs, etc.) and asteroids. It should be noted that many advances in this field came from the development and use of specific instruments and techniques (Tarady *et al.* 2010).

## 2. Astrometry of newly detected asteroids

Scientific programmes on studies of asteroids have been run at the Terskol Observatory (IAU code B18) since the early 2000s (Godunova *et al.* 2014). In May 2015, we started to observe asteroids discovered within the Gaia project. Objects have been selected from the list of recently discovered asteroids prepared by the GBOT group (gbot.obspm.fr/index.php?page=asteroids) and the Gaia-FUN-SSO team. Asteroids have been observed down to  $V \sim 21.5$  mag, with individual exposure times of 60–180 s. For astrometric measures, an accuracy of about 0.15 arcsec was achieved. As of today, we could detect the following asteroids: G01366, G01378, G01831, G01893, G01899, G01900, G01764, G01773, G05150, G05164, G05168, G05165, G05089, G05154, G05117, G05120, G05096, G05829, G05865, G06018, G06028, G06029, G06030. In addition to that, we detected about 30 known main-belt asteroids and two unidentified objects, which appeared in the main target fields. All the positions were submitted to the IAU Minor Planet Center (www.minorplanetcenter.net).



**Figure 1.** Follow-up of Gaia transients at Terskol Observatory. *Left:* The combined light curve of Gaia16bkf. *Right:* Gaia17asz, as seen with the 2-m telescope on 2017-03-24 (R filter).

### 3. Photometry of transients

In 2016–2017, a variety of Gaia transients discovered by ESA Gaia, DPAC and the Photometric Science Alerts Team (<http://gsaweb.ast.cam.ac.uk/alerts>) was observed at Terskol: Gaia16bkf, Gaia16bkn, Gaia16blg, Gaia16bnz, Gaia16bvs, Gaia16bvt, Gaia17agr, Gaia17agj, Gaia17aqm, Gaia17asz, Gaia17akp, etc. Some findings are listed below.

*Gaia16bkf* was detected at magnitude  $G=18.94$  on 2016-09-24. This star near the Galactic plane was found 0.6 mag brighter than during its previous observations by Gaia which had demonstrated a minor variability (about 0.06 mag) in the last 1.5 years. Follow-up of this object started at Terskol on 2017-10-03, just after the alert was published. The BVRI photometry was performed with the 2-m telescope; CCD images were calibrated using NOMAD field stars. Figure 1 (*left panel*) depicts a rapid decay of Gaia16bkf with changing its color within four days.

*Gaia16bkn* was discovered at magnitude  $G=18.34$  on 2017-10-01; it was previously classified as SN Ia by the GS-TEC (Blagorodnova *et al.* 2014). There was no previous detection of this object by Gaia; moreover, there is no progenitor object on archival images. Observations of Gaia16bkf showed that this object had dimmed from  $B=18.49\pm 0.05$ ,  $V=18.66\pm 0.02$ ,  $R=18.75\pm 0.06$  (on 2016-10-04) to  $B=19.05\pm 0.05$ ,  $V=19.05\pm 0.14$ ,  $R=19.29\pm 0.13$  (on 2016-10-07). The magnitudes were calibrated against NOMAD field stars; they are not corrected for the Galactic foreground extinction.

*Gaia17asz* was discovered at magnitude  $G=18.82$  on 2017-03-17. There is no progenitor object on archival images. We confirmed Gaia17asz with images taken with the 2-m telescope on 2017-03-24 (see Fig. 1, *right panel*). The following magnitudes of the object were derived:  $B=19.4\pm 0.1$ ,  $V=19.9\pm 0.1$ ,  $R=20.1\pm 0.1$  (calibrated against Gaia DR1 field stars; not corrected for the interstellar extinction).

These and other results obtained at Terskol demonstrate that ground-based small and medium-sized telescopes remain a valuable tool for monitoring and investigation of newly detected objects. It is obvious that more systematic, integrated use of these instruments could lead to better information about transient events in the Universe.

### References

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