

SCIENCE WITH BRITE-CONSTELLATION AT THE UNIVERSITY OF INNSBRUCK

K. Zwintz¹, R. Kuschnig², C. Arnold¹, F. Brüser¹, M. J. Dornacher¹, S. Gössl¹, A. Ivanov¹, M. Mayerl¹, M. Müller¹, M. Müllner¹, S. Panny¹, A. M. Stanciu¹, T. Steindl¹, A. Thaler¹, D. Weißmayer¹ and S. Zieba¹

Abstract. At the University of Innsbruck, BRITE-Constellation data of several types of variable stars are analyzed together with students as part of their bachelor theses or as course work during lectures. Here we show an overview of our recent team work including γ Doradus and δ Scuti stars as well as some stars showing variability caused by spots.

Keywords: Stars: variables: delta Scuti, Stars: variables: gamma Doradus, Stars: rotation

1 Data Reduction & Analysis

The raw BRITE photometry was corrected for instrumental effects including outlier rejection, and 1D and 2D decorrelations with all available parameters, in accordance with the procedure described by Pigulski (2018). The frequency analysis of the reduced and decorrelated BRITE photometric time series was performed using the software package Period04 (Lenz & Breger 2005). Frequencies were prewhitened and considered to be significant if their amplitudes exceeded 3.8 times the local noise level in the amplitude spectrum (e.g., Kuschnig et al. 1997). The analysis was verified using the iterative prewhitening method based on the Lomb-Scargle periodogram (Van Reeth et al. 2015).

2 γ Doradus stars

Three seasons of BRITE-Constellation observations of QW Puppis (HD 55892) were obtained in 2015, 2016/17, and 2017/18 with time bases of ~ 78 days, ~ 225 days, and ~ 167 days. 20 g-mode pulsation frequencies ranging from 0.7 to 3.6 d^{-1} were identified. A first investigation yielded a clear period spacing pattern with a mean ΔP of 3246 seconds.

For 39 Pegasi (HD 213617) single season observations in 2017 provided a time base of ~ 88 days. First signs for g-mode period spacings can be seen, but a longer time base is needed for a more detailed investigation.

3 δ Scuti stars

3.1 The δ Scuti star β Pictoris

β Pictoris was observed in two colors in the same three subsequent seasons by BRITE-Constellation as QW Puppis, i.e., from 2015 to 2018 with time bases of ~ 78 days, ~ 225 days, and ~ 167 days (see Zwintz et al. 2019). 15 significant pulsation frequencies were identified from the BRITE data. Additionally, a variability of the amplitudes of two of the pulsation frequencies was detected (Zwintz et al. 2019).

3.2 δ Scuti stars in the Taurus field

BRITE-Constellation observations of the Taurus field collected from September 2017 to March 2018 included nine δ Scuti stars. One of the δ Scuti pulsators in the Taurus field is the A7 star θ^2 Tauri with 14 identified pulsation frequencies in the range from 10 to 15 d^{-1} . (M. Müller, Bachelor thesis, University of Innsbruck).

¹ Universität Innsbruck, Institut für Astro- und Teilchenphysik, Technikerstraße 25, A-6020 Innsbruck, Austria

² Institut für Kommunikationsnetze und Satellitenkommunikation, Technical University Graz, Inffeldgasse 12, A-8010 Graz, Austria

4 Spotted stars

In the 45 fields observed by BRITE-Constellation since 2013, a wealth of stars showing rotational modulation caused by spots on the surfaces was observed. Many of these objects lacked precise photometric time series to derive the rotation periods. Such data are necessary to plan further spectroscopic and spectropolarimetric observations to study the distribution of chemical abundances on the surfaces, investigate chemical peculiarities, and measure potential magnetic fields. All present data have been downloaded from the BRITE-Constellation Public Data Archive*. 13 stars showing rotational modulation were analyzed as course work by a team of enthusiastic students that are also listed as co-authors of this article. Figure 1 shows the BRITE-Constellation data for five of these stars as examples. Future work will focus on the analysis of complementary spectroscopic data and a common interpretation with the BRITE photometry.

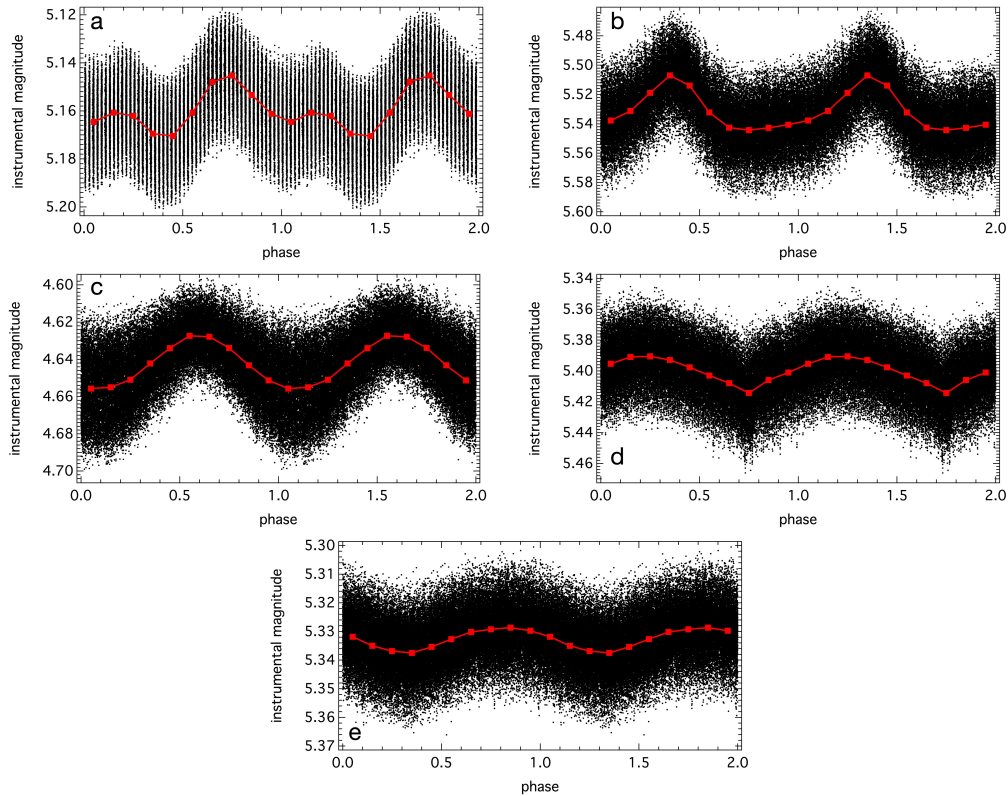


Fig. 1. Examples of spotted stars observed with BRITE-Constellation: Phase plots for the stars (a) HD 54118 (A0pSi), (b) HD 92664 (ApSi), (c) HD 64503 (B2), (d) HD 69144 (B2.5), (e) HD 99556 (B3).

References

- Kuschnig, R., Weiss, W. W., Gruber, R., Bely, P. Y., & Jenkner, H. 1997, *A&A*, 328, 544
 Lenz, P. & Breger, M. 2005, *Communications in Asteroseismology*, 146, 53
 Pigulski, A. 2018, in *3rd BRITE Science Conference*, Vol. 8, 175–192
 Van Reeth, T., Tkachenko, A., Aerts, C., et al. 2015, *A&A*, 574, A17
 Zwintz, K., Reese, D. R., Neiner, C., et al. 2019, *A&A*, 627, A28

*<https://brite.camk.edu.pl/pub/index.html>