Abstract. HD 54967 was observed by TESS with a 2-min cadence in Sectors 1 and 2. Its light-curve revealed a rich frequency spectrum, mostly in the region of high-order g-modes. That meant that the star is a Slowly Pulsating B-type pulsator. Our frequency analysis indicated the presence of quasi-equal period spacings, which support mode identification and detailed seismic modelling. We present the results of our initial analysis of the star. Further studies should supply constraints on physical processes occurring inside it, including various types of mixing processes.

Keywords: Stars: individual: HD 54967, variables: general, asteroseismology

1 Introduction

The luminosity of the star was calculated from the Gaia DR2 parallax (Gaia Collaboration et al. 2016, 2018; Lindegren et al. 2018), and bolometric correction from Flower (1996). The evolutionary tracks shown in the H–R diagram in the left panel of Fig. 1 were calculated with the MESA code (MESA Paxton et al. 2011, 2013, 2015, 2018), version 11701. We adopted a metallicity \( Z = 0.01 \) and an exponential overshooting parameter \( f_{ov} = 0.01 \) from the hydrogen-burning convective core (Herwig 2000), a hydrogen abundance \( X = 0.7 \) and the OPLIB opacity tables (Colgan et al. 2015, 2016). Two values for the rotational velocity were studied, \( V_{\text{rot}} = 0 \) km s\(^{-1}\) and 200 km s\(^{-1}\).

From the TESS light-curve of HD 54967 we derived about 200 independent frequencies. Most of them occupy the low-frequency region, but there are frequencies as high as 10 d\(^{-1}\). The frequency spectrum is shown in the upper right panel of Fig. 1.

![Fig. 1.](image.png)

The frequency spectrum is very dense, and there are no obvious quasi-equal period spacings. However, a more detailed analysis revealed some regular structures. The lower right panel of Fig. 1 shows the most interesting frequency sequences in the diagram of period vs. period difference.
Some of the sequences we found may be accidental. A detailed analysis consisting of simultaneous mode identification and frequency fitting is required in order to establish physical sequences of frequencies with the same degree and consecutive radial orders. For more information on the subject see [Szewczuk & Daszynska-Daszkiewicz (2018)].

Here we present the result of a very preliminary analysis. The model fits frequencies from frequency sequence No. 8 under the assumption that it is a dipole mode series. We derived the following parameters: mass $M = 4.716 M_\odot$, rotational velocity $V_{\text{rot}} = 70 \text{ km s}^{-1}$, effective temperature $\log T_{\text{eff}} = 4.1778$ and luminosity $\log L/L_\odot = 2.9206$.

2 Conclusions

Analysis of the TESS data obtained for HD 55967 resulted in the detection of a large number of pulsational frequencies. Most of them are low frequencies ($g$-modes) typical of SPB type stars. A detailed study of the frequency spectrum revealed a few frequency series that can be associated with consecutive radial orders of modes with a given mode degree ($\ell$) and azimuthal number($m$). Further seismic modelling of the star should yield constraints on different mixing processes that take place inside the star.

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References

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