A search for planetary transits among stars in the lower part of the classical instability strip in short-cadence Kepler data revealed KIC 8197761 as the best candidate. The detected periodic dimmings with a period of 9.87 d and an amplitude of about 6 mmag are however due to grazing transits of an M dwarf star. Our analysis of the γ Doradus pulsation implies an internal rotation period of 300 d, whereas the measured v sin i is consistent with the hypothesis of the envelope rotation period - 30 times faster than in the stellar interior - being synchronized with the binary orbit.

**Variability content of the light curve**

The Fourier spectrum is shown in Fig. 2. Several hundreds of frequencies are present in the frequency range from 0.1 to 5 c/d. Interestingly, several of the dominant oscillations are part of multiplets (mostly triplets, sometimes doublets) equally spaced in frequency, and are often the centroid frequencies. We determine the weighted mean frequency spacing of these multiplets: \( f_{\text{sp}} = 0.001659(15) \) c/d.

**Asteroseismology**

As we classified KIC 8197761 as a γ Doradus pulsator, the pulsational signals are likely gravity modes of the same spherical degree l split by rotation. Asymptotic pulsation theory (e.g., Tassoul 1980) predicts that such modes with consecutive radial overtones should be equally spaced in period. Equal spacings of signals within data sets can be realized also by showing their spectral window which is shown in Fig. 3.

This analysis suggests the presence of a mean period spacing of 2770 ± 40 s, with a second possibility for a mean period spacing of 1670 ± 20 s. This is interesting, as the mean period spacings of high-order gravity modes such as excited in γ Doradus stars should relate as \( \Delta P_{l=1}/\Delta P_{l=2} = \pi/3 \) (Unno et al. 1989), and that is not the case. The ratio of these two potential mean period spacings is 1.66 ± 0.04, almost 2σ from the asymptotic value.

An Echelle Diagram with respect to the 2770 s mean period spacing, is shown in Fig. 4. The signals that are components of multiplets with equal frequency splittings roughly fall onto a vertical segment. The two signals that do not are in fact combination frequencies. Therefore, we conclude that the equally-split frequency multiplet structures with periods between 0.7-1.7 d are indeed due to \( l \) modes of the same \( l \) because:

1) the multiplets have a maximum number of three members, 2) the mean \( l=1 \) period spacing of ZAMS models of γ Doradus stars is about 3000 s, and 3) geometrical cancellation over the visible stellar disk (Dziembowski 1977) favours the observations of \( l=1 \) modes in comparison to higher \( l \), we identify these multiplets as rotationally split \( l=1 \) modes.

The \( l=1 \) multiplets do not fall onto an exact vertical ridge in the Echelle Diagram; some "wavy" structure is superposed. This is an effect of mode trapping, caused by the sharper density gradients in the stellar interior as the object evolves, and it can be taken advantage of to constrain its evolutionary state (see, e.g., Saio et al. 2015 and van Reeth et al. 2015 for examples).

**Spectroscopy**

We also determined the projected rotational velocity of KIC 8197761 from 13 spectra obtained with the 1.2-m Mercator Telescope and HERMES spectrograph. The Fourier spectrum is shown in Fig. 2. Several hundreds of frequencies are present in the frequency range from 0.1 to 5 c/d. Interestingly, several of the dominant oscillations are part of multiplets (mostly triplets, sometimes doublets) equally spaced in frequency, and are often the centroid frequencies. We determine the weighted mean frequency spacing of these multiplets: \( f_{\text{sp}} = 0.001659(15) \) c/d.

**References**


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