Baltic Astronomy, vol. 14, XXX–XXX, 2005.

A NEW LARGE AMPLITUDE SLOWLY PULSATING sdB STAR

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Received 2005 ***

Abstract.
We report the discovery of a new large-amplitude slowly pulsating sdB star, EC 21324–1346. Although we have only a small amount of data, it is clear that the star exhibits more than one mode of variation; the present data can be adequately represented with three or four frequencies in the range 170 – 330 μHz (about 0.8 to 1.6 hours). The amplitude of the dominant frequency is about 0.004 mag – large for a slowly pulsating sdB star.

Key words: stars: oscillations – stars: horizontal-branch – stars: individual (EC 21324–1346)

1. INTRODUCTION

The slowly pulsating sdB stars were discovered as part of a campaign by Dr E. Green and her collaborators (Green et al. 2003) to find and monitor sdB stars in binary systems. As with the rapidly pulsating sdB stars, the slow pulsators have amplitudes $<$ 0.01 mag – often much less – but longer periods, typically 1 – 2 hours. The slow pulsators also appear to be multi-periodic and, like the rapid pulsators, the nomenclature for the slow pusators is undecided – they are also called "Betsy" stars, after the discoverer, and PG 1716+426 stars after the prototype.

The Edinburgh–Cape (EC) survey (Stobie et al. 1997; Kilkenny et al. 1997) has discovered many new sdB stars and since the discovery of the fast pulsators (Kilkenny et al. 1997) these are being checked for variability, but generally only for short intervals of $\sim$ 2 hours, so that low-amplitude slow pulsators might have been missed. The star reported here, EC 21324–1346, was of such a large amplitude, that even we couldn't miss the variability, even in a relatively short run.

EC 21324–1346 is located at $\alpha = 21^h\ 35^m\ 13^s,\ \delta = -13^\circ\ 33'\ 23''$ (2000.0). A preliminary spectral type from the EC survey is "sdB", but no survey *UBV* photometry has yet been obtained. The photographic magnitude from the plate measurement indicates $B \sim 13$ mag.

2. OBSERVATIONS

Observations were made with the University of Cape Town's frame-transfer CCD on the 1.9m and 1.0m telescopes at the Sutherland site of the SAAO. Details are listed in Table 1 and the longest run is shown in Fig1.

Table 1. UCT CCD observation log for EC 21324–1346

Date (2003)	JD	Tel (m)	Filter	Run (hr)	Integr (sec)
Jul 15/16	2453202	1.9	BG39	2.0	10
Sep 07/08	3258	1.0	–	4.1	30
Seo 09/10	3259	1.0	–	6.3	40

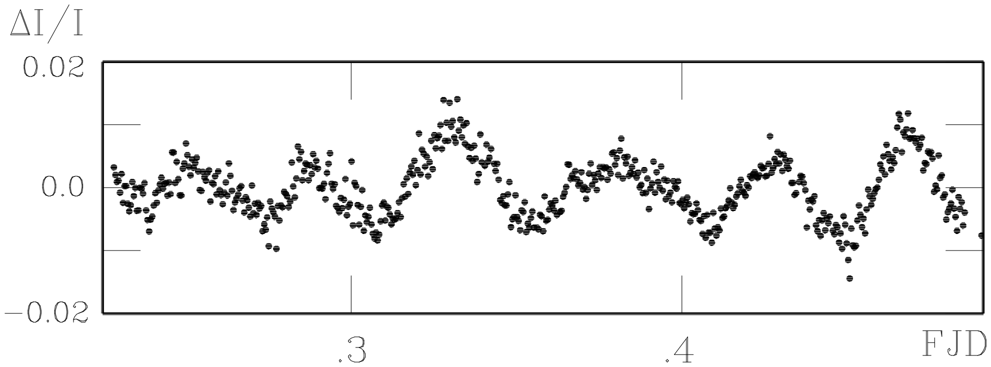

Fig. 1. Relative intensity light curve for EC 21324–1346 on JD 2453259 (40 second integrations; no filter).

3. ANALYSIS

The usual Fourier analysis has been carried out. The night JD 2453259 is the longest run, and we found at least four frequencies clearly above the noise level (see Fig.2). Of course, with such a short data set – covering very few cycles – it is optimistic to think we can extract four frequencies. But inspection of Fig. 1 indicates that the variations are clearly not mono-periodic and even that probably more than two frequencies are present.

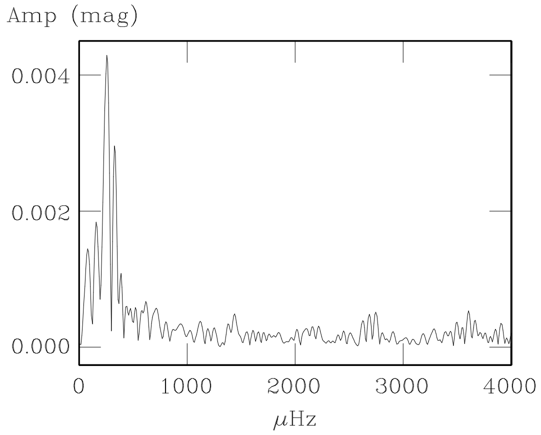

Fig. 2. Periodogram from Fig 1 data for EC 21324–1346.

We have repeated the analysis for the two consecutive nights – JD 2453258 and JD 2453259 – together. We extract the same four frequencies and Fig. 3 shows the best four frequency fit to the data for the two nights.

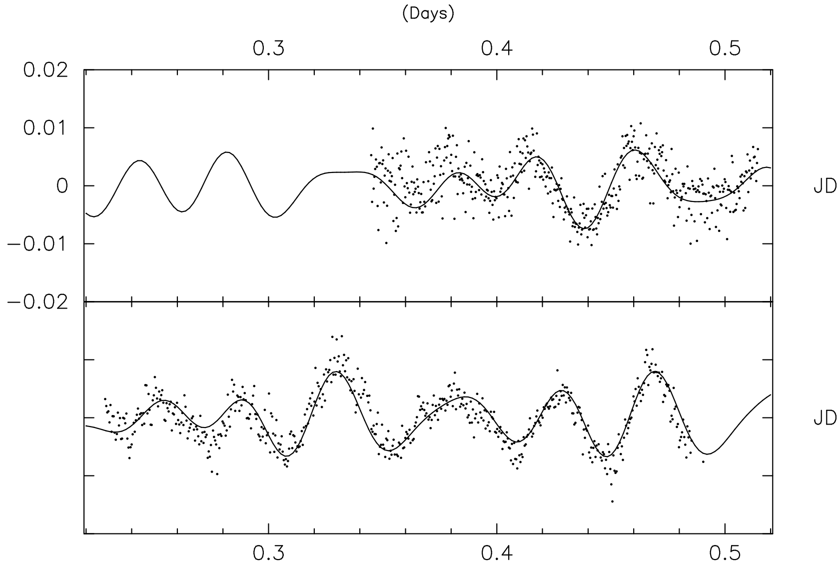

Fig. 3. Four frequency fit to EC 21324–1346 data for JD 2453258 and 3259.

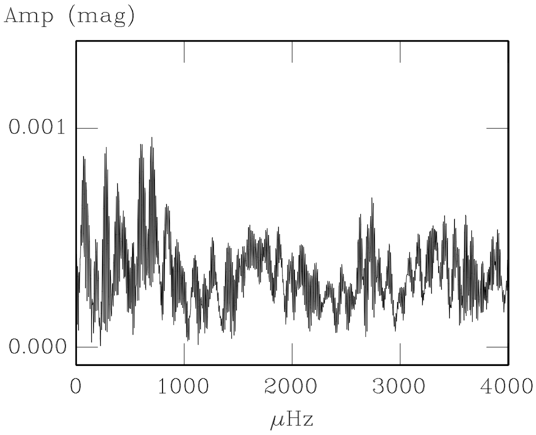

Fig. 4. Periodogram for the EC 21324–1346 data for JD 2453258 and 3259, after the removal of the four strongest frequencies.

4. CONCLUSIONS

EC 21324–1346 is an sdB star which exhibits multi-periodic variation with periods in the range $\sim$ 0.8 to 1.6 hours (see Table 2). It is clearly a slowly-pulsating star of the type discovered by Green et al. (2003) and has rather a large amplitude – for this class of star.

Table 2. Four frequencies extracted from Fig. 2 data (best fit to two nights).

Frequency (Hz)	Ampl.(mag)	Period (s)	Period (hr)
0.000253	0.0037	3950	1.10
0.000332	0.0022	3010	0.84
0.000175	0.0022	5710	1.59
0.000226	0.0016	4420	1.23

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