EPIC 212707862, a pulsating subdwarf B star from Kepler K2 mission.

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Introduction

B-type subdwarfs (sdB) are stars located on the extended horizontal branch, with masses around 0.5 Solar Mass. There are still doubts about the formation and evolution of these stars. Discovery of two types of pulsations (pressure - and gravity-driven) makes asteroseismology very useful in studying these stars. The nature of the pulsations and small number of known stars of this type means that only data collected from space is good enough to allow identification of pulsation modes in the Fourier spectrum, which is necessary to create reliable models of these stars.

Kepler mission

Data from the Kepler spacecraft revolutionised our knowledge of these objects: thanks to the data gathered during the original mission, researchers found and examined 19 pulsating sdB stars. Unfortunately, the failure of a second reaction wheel made observation of the original field of view impossible. After that, the K2 mission was started, in which a different field of view was observed every 3 months. It increased the chances of discovery of a larger number of pulsating sdB stars. Unfortunately, the data from the K2 mission is less precise than data from the primary mission. We encounter thruster firings, which create discontinuities in the data. This poster presents our analysis of Kepler K2 data of EPIC 212707862.

Data

We used short cadence data collected with the Kepler spacecraft. This star were continously monitored for over 78 days (from July to September 2015). We downloaded target pixel data from MAST; extracted; detrended and 4σ clipped. Next we calculated the amplitude spectra (shown below) and selected all modes with amplitudes above noise level (0.058 ppt). The original amplitude spectrum is given with the red line while residuals after frequencies removal are plotted with green line.

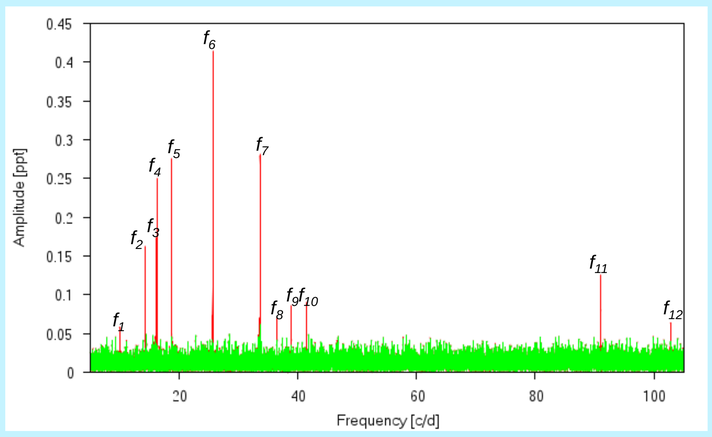

Figure: Amplitude spectrum as a function of frequency for EPIC 212707862

Results

As we can see, EPIC 212707862 is a g-mode sdBV. In total we fitted 12 significant frequencies and listed it in table showed below (Figure 1). Table contains periods, amplitudes and our assumption of modal degrees. We successfully identified modal degrees for 11 out of 12 detected frequencies. The graph below (Figure 2) shows amplitude spectrum as a function of period. We have searched for multiples of ≈250 s (*l*=1) or ≈145 s (*l*=2) for spacings in period sequence and since we had only 12 frequencies we could test all possible combinations. As a result we matched 6 frequencies for *l*=1 (dashed line) and 5 for *l*=2 (dotted line). Finally, using linear regresion method (Figure 3), we derived the avarange spacings of 252.64 s for *l*=1 and 146,09 s for *l*=2 sequence. The ratio between spacings of both sequences agrees with the theory.

ID	Frequency [c/d]	Period [s]	Amplitude [ppt]	*l*
f_1	9.94165	8690.71	0.058	
f_2	14.30013	6041.90	0.161	2
f_3	16.05733	5380.72	0.173	1
f_4	16.25985	5313.70	0.248	2
f_5	18.73711	4611.17	0.278	1
f_6	25.65574	3367.67	0.415	1
f_7	33.59876	2571.52	0.280	1
f_8	36.47234	2368.92	0.071	2
f_9	38.87045	2222.77	0.0856	2
f_{10}	41.42062	2085.92	0.089	1
f_{11}	91.07401	948.68	0.127	2
f_{12}	102.79983	840.47	0.064	1

Figure 1: List of fitted and significant frequencies detected in EPIC 212707862

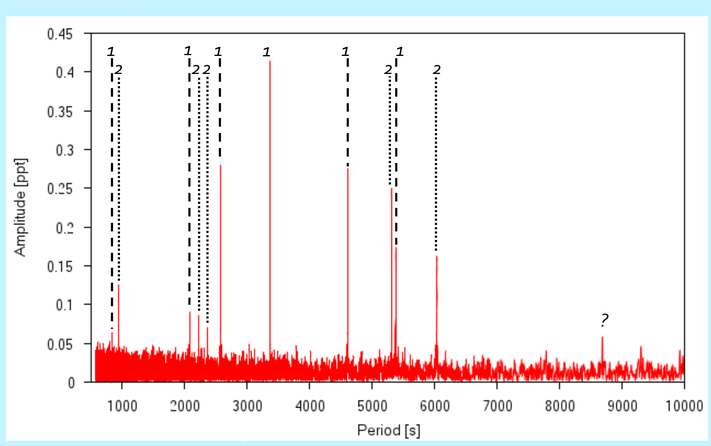

Figure 2: Amplitude spectrum as a function of period for EPIC 212707862

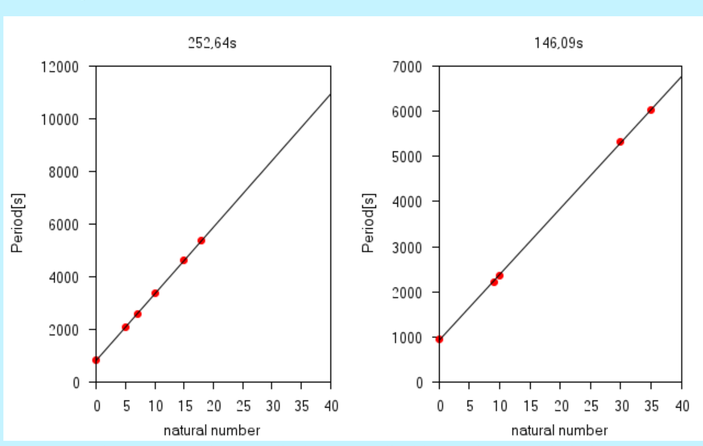

Figure 3: Linear fit for *l*=1 (left) and *l*=2 (right).

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