Draft version October 17, 2023
Typeset using LaTeX default style in AASTeX631

β Cephei pulsators in eclipsing binaries observed with *TESS*

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ABSTRACT

The combined strength of asteroseismology and empirical stellar basic parameter determinations for in-depth asteroseismic analysis of massive pulsators in eclipsing binaries shows great potential for treating the challenging and mysterious discrepancies between observations and models of stellar structure and evolution of massive stars. This paper compiles a comprehensive list of massive pulsators in eclipsing binary systems observed with *TESS*. The *TESS* light curves and Discrete Fourier Transforms (DFT) of a sample of 8055 stars of spectral type B0-B3 were examined for eclipses and stellar pulsations and the ephemerides of the resulting sub-sample of massive pulsators in eclipsing binaries were computed. This sub-sample was also cross-matched with existing catalogues of massive pulsators. Here we report a total of 78 pulsators of the β Cephei type in eclipsing binaries, 59 of which are new discoveries. Forty-five are recognized as definite and 33 are candidate pulsators. Our sample of pulsating massive stars in eclipsing binaries allows for future asteroseismic modelling to better understand the internal mixing profile and to resolve the mass discrepancy in massive stars. We have already started follow up of some of the most interesting candidates.

Keywords: asteroseismoloy -binaries: general - stars: evolution - massive stars: oscillations (including pulsations) -stars: rotation

1. INTRODUCTION

Asteroseismology is the study or science of determining the interior structure of stars from their oscillations/pulsations (e.g., Gough 1985; Handler 2013; Aerts 2021). These oscillations exist in the form of radial or nonradial oscillation modes. Radial oscillation modes are seen in classical pulsators (e.g. Cepheid, RR Lyr stars and Miras) and show strong relevance in observational cosmology (e.g., Anderson & Riess 2018). On the other hand, nonradial oscillation modes are of interest in asteroseismology. They are solutions to equations of motion of a star that gets perturbed from its equilibrium (Aerts 2021). The nonradial modes are mainly of two types, depending on which of the forces (pressure or buoyancy) is dominant in restoring the equilibrium. Modes that are restored by the pressure force are called pressure modes (p modes) and those that are restored by buoyancy are termed gravity modes (g modes). While p modes have large amplitudes in the envelopes of the stars and are characterised by dominant radial motions, g modes have large amplitudes in the deep interior of the star and are characterised by dominant horizontal motions. Another class of nonradial oscillation mode are called mixed modes, that have p-mode character in the envelope and g-mode character in the deep interior and shows excellent probing power in the entire star

Massive stars also show pulsations (e.g., Bowman 2020) and offer very unique opportunities to constrain their properties via asteroseismology (Aerts et al. 2010). Three classes of massive pulsators exist, namely: β Cephei stars which are early B type main sequence stars with masses of approximately 9 – 17 $M_\odot$, low radial order pressure (p), gravity (g) and mixed modes, pulsation amplitudes up to a few tenths of magnitudes and pulsation periods of several

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hours (approximately 2 to 6 hours) (e.g., Sterken & Jerzykiewicz 1993; Aerts & De Cat 2003; Stankov & Handler 2005; Handler 2013), Slowly pulsating B (SPB) stars which are mid-to-late B stars of masses 3 − 9 $M_\odot$ with high radial order g-modes and observationally challenging periods of the order of days (approximately 1 to 4 days) (e.g., Waelkens 1991; Waelkens et al. 1998) and a third group which shows stochastic low-frequency (SLF) variability and have quasi-periodic and time-dependent variability spanning a broad range of periods from order of minutes to several days (e.g., Bowman et al. 2019a,b, 2020). Following the relative abundance of pulsators of spectral type B compared to O stars, the majority of the constraints on the stellar structure and evolutionary theory of massive stars currently are believed to come from β Cep and SPB stars (Aerts et al. 2019; Bowman et al. 2020). β Cep are adjudged to be supernova progenitors and their roles in shaping galaxy dynamics or its chemical enrichment are crucial. Although they predominantly pulsate in p modes (Stankov & Handler 2005), they also have g and mixed pulsation modes (e.g., Handler et al. 2017). These make them very important in seismically probing the entire star. Their understanding gives us insight into the properties of massive stars such as rotational mixing, convective core overshooting e.t.c. as well as the transition from main sequence to hydrogen-shell burning evolution of massive stars (Neilson & Ignace 2015). Owing to these features, especially core convection, uncertainties in the stellar structure and evolution theory are largest for stars of O and B categories (Pedersen et al. 2019), and hence, compound the problem or mystery of mass discrepancy in massive stars. The mass discrepancy problem is a situation where the masses of stars inferred from spectroscopy are different from the masses derived from models of stellar evolution (Herrero et al. 1992; Tkachenko et al. 2020).

Massive stars are predominantly found in multiple systems (Sana et al. 2012, 2014; Kobulnicky et al. 2014; Southworth & Bowman 2022a), hence, a substantial fraction are expected to also be located in eclipsing binaries. Southworth (2012) in line with Russell (1948) and Batten (2005) described 'eclipse' as the royal road to stellar astrophysics. By modeling eclipses, model-independent precise stellar parameters (e.g. radius, mass), which serve as invaluable calibrators for stellar evolution theory (Torres et al. 2010; Pedersen et al. 2019) are obtained. Dynamical masses deduced from eclipsing binary modelling and asteroseismic masses offer quite unique opportunities to constrain the physics of stellar evolution models to treat the challenging and mysterious discrepancies between observation and models (Tkachenko et al. 2020). Unfortunately, the absolute numbers of reported massive stars in eclipsing binary or multiple system are significantly smaller compared to their low mass counterparts (Kirk et al. 2016; Pedersen et al. 2019). However, *TESS* (Ricker et al. 2015) is out to change this narrative. It is the first precision photometry mission that surveys (almost) the whole sky and has released, in large amounts, time resolved photometry of stars of O and B spectral types (e.g., Handler et al. 2019) with a precision comparable to *Kepler* and K2 but for stars five magnitudes brighter owing to its smaller telescope aperture. Since the advent of the *TESS* mission, there has been concerted effort by researchers in the field to obtain comprehensive and adequate sample size of massive pulsators for massive star asteroseismology to improve the physics of the stellar structure and evolution models of massive stars using the *TESS* data. These efforts are to compensate for the lack of sufficient number of such stars observed with high-precision space photometry prior to *TESS* (Aerts et al. 2010; Handler 2013) and to gather a pool of suitable candidates for in depth asteroseismic analysis. This major barrier of small sample size thus far hampered the general asteroseismic understanding of high mass stars.

A number of authors have published catalogues of massive stars in the recent past. Pedersen et al. (2019) presented the classification of variability of 154 massive stars with spectra types O and B that were observed by *TESS* in short cadence (2 minutes). Their sample consisted of single or binary stars of diverse variability and was aimed at establishing an unbiased sample for O and B stars for future asteroseismology. A similar search has been conducted by Burssens et al. (2020).

To combine the strengths of eclipsing binary modelling and asteroseismology, a lot of other recent searches have been either narrowed down to massive pulsators in eclipsing binary systems or done in larger scales to capture more massive eclipsing binaries in the sample (Southworth 2015; Southworth et al. 2020, 2021; IJspeert et al. 2021; Zari et al. 2021; Southworth & Bowman 2022a). While some of these authors focused mainly on identifying eclipsing binaries, these works still play a significant role in the search for β Cep pulsators in eclipsing binaries as they provide lists of already existing eclipsing binaries. Whereas Southworth (2015), Southworth et al. (2020, 2021) and Southworth & Bowman (2022a) have small numbers of massive pulsators in their samples as they were more interested in detached eclipsing binaries, IJspeert et al. (2021), on the other hand, published a large sample of massive stars comprising single stars and eclipsing binaries in their effort to identify eclipsing binaries in OBA-type stars. However, they limited their search to stars of *TESS* magnitude below 15 with colour indices $J - H < 0.045$ and $J - K < 0.06$. There is a large overlap between the catalogue of OBA-type stars compiled by IJspeert et al. (2021) and that compiled by Zari et al. (2021) which used a Gaia magnitude cut of $G < 16$ as one of their major selection criteria. Here, we aim to compile a comprehensive catalogue of early B-type (B0–B3) pulsators in eclipsing binaries observed by *TESS* with a particular focus on β Cep stars, in order to harness the combined potentials of eclipsing binary stars and asteroseismology to probe the evolution and properties of massive stars. The spectral range we selected is expected to yield a comprehensive homogeneous sample of massive main sequence pulsators with self-excited p, g and mixed modes needed for the overall asteroseismic probe of massive pulsators. In section 2, we describe the sample, its observation and selection criteria. In section 3, we describe the analysis. We discuss the results of the variability classification and periodicity of the pulsators in our sample in section 4 and draw the necessary conclusions in section 5.

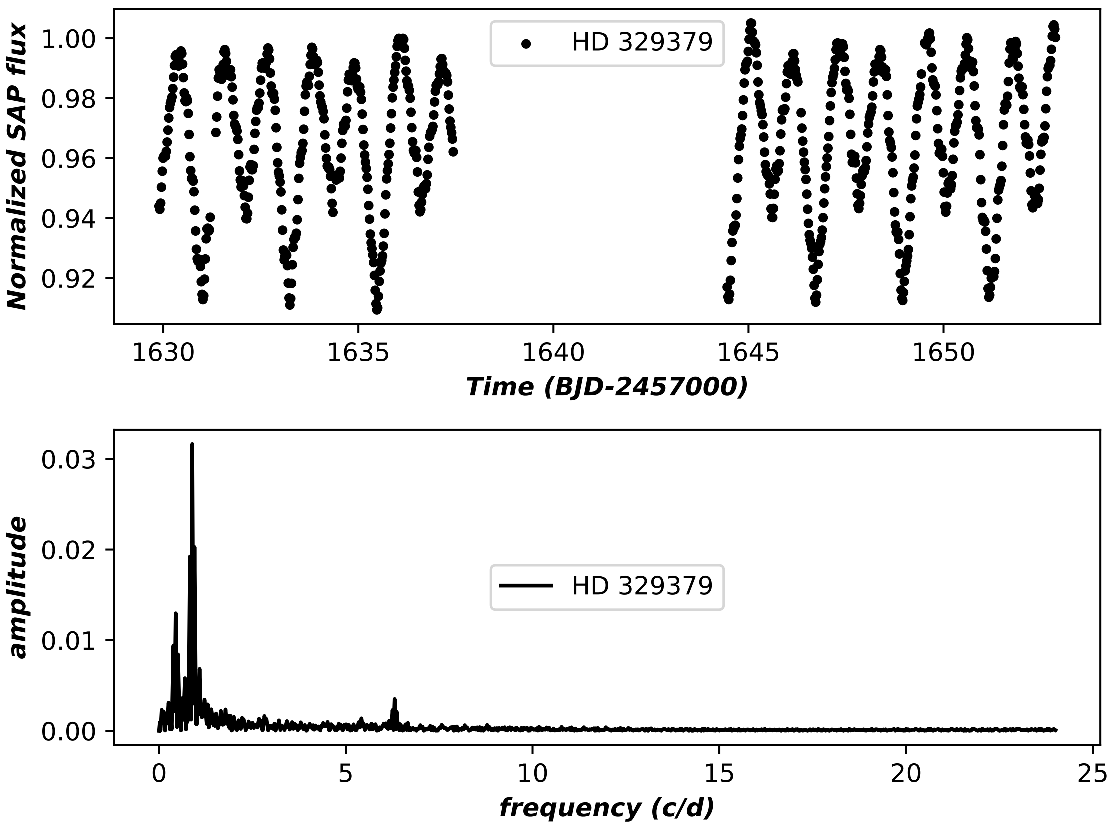

Figure 1. An example figure of the light curve and DFT of a hybrid pulsator in eclipsing binaries.

2. SAMPLE SELECTION AND OBSERVATION

The photometric data used for this work are the *TESS* 30-minute cadence light curves (QLP data) (Huang et al. 2020a,b), obtained from the Barbara A. Mikulski Archive for Space Telescopes (MAST) and observed in the first two cycles of *TESS*, covering sectors $1 - 26$. We compiled a total of 8055 stars of spectra type B0-B3 from the spectral catalogue compiled by Luis Balona[1] and extracted the *TESS* long cadence light curves from MAST. For stars in our sample with available 2 minute cadence data at the time of this work, we also examined the 2 minutes cadence light curves. The sample spans a V magnitude range $3.23 - 12.33$ and a B magnitude of $3.01 - 12.96$. As a result, it includes both bright and dim stars with varying morphology. In terms of morphology, eclipsing binary stars are classified as detached, semi-detached and over-contact binaries (see Kallrath & Milone 2009, for details). While detached eclipsing binaries are more convenient to work with, comparing an ensemble of detached binaries with

[1] http://redcliffcottage.co.za/TESS/

those experiencing strong tidal forces, one understands the importance and role of tidal forces in the internal processes (IJspeert et al. 2021). Hence, our search is not restricted to detached eclipsing binaries but includes massive β Cep pulsators in eclipsing binaries of different *morphological classifications* with self-excited pulsations. Irrespective of the importance of Stochastically Low Frequency (SLF) variables in the study of massive stars via internal gravity waves, we ignored them during the selection of pulsators from our sample.We also ignored the SPBs in our sample during the selection owing to their mass range which is not within the β Cep regime of interest. However, any hybrid massive pulsator with self-excited pulsations and β Cep component was included in the sample of pulsators. Hereinafter, we shall refer to the entire list of the stars examined as "the sample" and refer to the list of eclipsing binaries in the sample with β Cep pulsating component(s) as "the sample of pulsators".

3. ANALYSIS

To preselect candidates, we first plotted the light curves and the Discrete Fourier Transforms (DFT) of each of the 8055 stars. Via visual examination of the plots, stars which show eclipses as well as frequency peaks in the regimes of the β Cephei were preselected. Here, we considered pulsations with frequencies, $f \geq 3$ c/d as β Cep pulsations. Owing to the effect of binarity, some of the frequency peaks adjudged to be independent frequencies sometimes appear to be harmonics of the orbital frequency or could be hidden within a forest of peaks in the DFT caused by the orbital light variations. In a few cases, the pulsational signals were of higher amplitude than the eclipses, which would then manifest themselves as a series of low-frequency harmonics in the DFT. As a result, successive prewhitening of each of the light curves of the stars in the preselected sample was done using the *Period04* software (Lenz & Breger 2005).

The *Period04* software (Lenz & Breger 2005) applies discrete frequency Fourier analysis and simultaneous multi-frequency least square fitting. Calculation of light curve fits for multi-periodic signals such as harmonics, combination and equally spaced frequencies are also possible in the program. To remove the effect of binarity from the light curve, we fitted the orbital frequency and all its detected harmonics and subtracted the fit from the light curve resulting in a residual that would contain the pulsational signals only. We further prewhitened this residual to check for independent frequency peaks. For the prewhitening, we used a Nyquist frequency of 23.5 c/d and accepted independent pulsation frequencies with S/N $\geq$ 4.5 as real frequencies. For the sake of this classification, we did not do exhaustive prewhitening of the residual to extract all the frequencies. Since our interest is to compile massive pulsators and not the exact number of pulsations they have, we only considered few dominant peaks and in cases where hybrid pulsation is suspected, we continued the prewhitening until the frequencies are enough to establish or disprove it as a hybrid pulsator. Figure 1 shows an example light curve and DFT of a hybrid pulsator in the sample.

The stars in the preselected sample, which have shown independent pulsation peaks were subjected to further checks for false eclipses and blends. The light curves of the stars (especially in crowded regions on the sky) are sometimes modulated by stray light from neighbouring stars which blends with their light. Owing to blends, there have been incidences of false eclipses in stars or pulsations wrongly attributed to stars that they do not originally come from. To correct for blends, we conducted photometric checks and analysis using eleanor (Feinstein et al. 2019; Brasseur et al. 2019; Burke et al. 2020). Eleanor is an open source python based package used for downloading, extraction, analysis and visualization of flux corrected light curves from *TESS* Full Frame Images (FFIs). Using eleanor, we extracted the *TESS* target pixel files, plotted colour-coded pixel-to-pixel flux corrected light curve and DFT of the target(s). For targets where the eleanor default aperture appeared not to be very suitable, we defined a custom aperture mask. Figure 2 shows the cut out session of the aperture and pixel-to-pixel light curves of one of our targets (V1216 Sco). To rule out the effect of contamination by other possible sources within the aperture or pixel, we over-plotted the optimal apertures over Gaia sources of 5 mag fainter than the targets. According to Pogson's Equation we thus assumed that a star which is 100 times fainter than the target could have negligible blend or modulation effect on the light curves and pulsations of the target(s). By examining the pixel-to-pixel light curves and the overlaid plots, we rule out possible effects of blends and either accept or reject the pre-identified eclipses and pulsations as genuine. On the other hand, independent pulsations could be matched directly with the stars within the *TESS* pixel using another python module called *TESS*-Localize (Higgins & Bell 2022). In this case, individual pulsations are traced to their origin within the *TESS* target pixel file. A signal with periodogram peak that exceeds 7.5 times the average local noise level in the periodogram can be localized. This latter approach was only considered in situations where it becomes ambiguous to decipher, from the former, where the pulsation(s) come from. As pointed out earlier, we only considered few dominant peaks which were used for the purpose (where necessary). In cases where the peaks were traced to neighbouring stars, more pulsation frequencies of the star were extracted and subjected to similar procedure using *TESS*-Localize until the target is established or disproved to have pulsations.

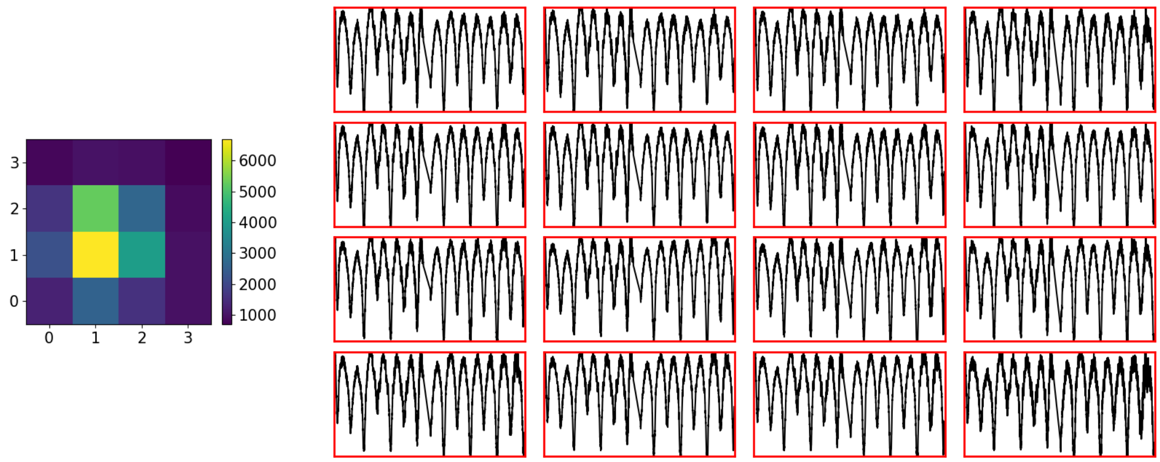

Figure 2. A cut-out session of the pixel-to-pixel plot of the aperture mask for V1216 Sco.

To compute the ephemerides of the pulsating sample, period analysis was conducted. We computed the orbital period of the stars using the box-fitting least squares, BLS (Kovács et al. 2002) and Lomb-Scargle, LS (Scargle 1982) periodograms incooperated in the LC periodogram solver of PHOEBE 2 program (Prša et al. 2016). The precision of the period obtained may improve during the detailed modelling of the light and radial velocity curves of the individual stars, which is beyond the scope of this paper. In that case, the absolute parameters of the stars could be estimated via the joint modelling of the light and radial velocity curves and also involves the implementation of the phoebe optimizer and MCMC sampler (emcee), which were not implemented for the sake of the selection in this paper. However, the estimated periods were refined further during prewhitening using period04.

4. RESULTS AND DISCUSSION

4.1. *Classification of pulsators*

Here we present the results of the analysis of the *TESS* photometry of 8055 stars. We report a total of 80 binary systems out of which we classify 49 as definite eclipsing binaries containing β Cep pulsators; a further 31 systems are listed as candidates that need further confirmation There are also ten possible ellipsoidal variables pulsating components in our sample. The full lists of the definite β Cep pulsators and pulsating candidates as well as ellipsoidal variables with their orbital ephemerides are shown in Tables $1-3$. Table 1 shows the list of definite β Cep pulsators in eclipsing binaries. Stars with some unresolved blends and weak pulsations for which we were unable to unambiguously pinpoint the source of the pulsations and/or eclipses are listed as eclipsing β Cep candidates and are shown in Table 2. Table 3 lists possible ellipsoidal variables with β Cep pulsating component(s). Objects that may appear to be β Cep pulsators in eclipsing binaries but according to our analyses are not are shown in Table 4. Stars which were rejected at the early stage of the analysis for conspicuously showing neither eclipses nor β Cep pulsations are not included in Table 4. The phase diagrams of light curves and out of eclipse Fourier spectra of the stars in Tables $1-3$ are shown in Figures $3-7$ respectively. The phase diagrams of stars with incomplete ephemerides or insufficient data to give reliable phased light curves were removed from Figures 3 and 4.

The sample of pulsators also contains stars whose photometric variability had been previously identified in literature. 16 Lac (Jerzykiewicz 1980), HD 101838, V4386 Sgr and V916 Cen which have been previously identified as β Cep stars in eclipsing binaries (e.g. Pigulski & Pojmański 2008; Chen et al. 2022) are corroborated by *TESS* photometry. Several others such as HD 339003 and HD 344880 which were discovered to be β Cep stars in eclipsing binaries in the KELT project by Labadie-Bartz et al. (2020), λ Sco from space- and ground based data (Bruntt & Southworth 2008; Handler & Schwarzenberg-Czerny 2013) are also corroborated by the *TESS* photometry. Further findings in the literature using the *TESS* data which are corroborated by the results of the analysis in this paper include: V453 Cyg (Southworth et al. 2020), VV Ori (Southworth et al. 2021), V446 Cep, HD 76838 and HD 227877 (Chen et al. 2022),

Table 1. List of definite β Cep pulsators in eclipsing binary systems with their orbital ephemerides and dominant pulsation frequencies. T_0 is the epoch, f_{puls} is the dominant β Cep pulsation and a_{puls} is the amplitude of the dominant β Cep pulsation.

ID	TIC ID	RA	Dec	Class of Variability	Mag B	Mag V	P_{orb} (d)	T_0 (BTJD)	f_{puls} (c/d)	a_{puls} (mmag)	S/N	Spec. type	Ref.
16 Lac	129538133	22 56 23.63	+41 36 13.95	EB+bCep	5.436	5.587	12.0951(5)	1748.220(2)	5.9112	6.1997	127.9	B2IV	L10, J80, W51
BD+44 3594	353099086	20 49 11.59	+45 24 39.79	EB+bCep+SPB	10.37	9.85	>33	2809.36(40)	6.8169	0.7553	16.6	B1:V:nep	
BD+44 3664	330081196	20 59 55.99	+45 20 12.94	EB+bCep	10.64	10.15	4.80323(6)	1713.45(5)	7.4862	7.0300	66.8	B1Vn/B9	
CD−38 4128	134522557	08 09 28.64	-38 51 29.28	EB+bCep	10.12	9.75	5.730(2)	1494.955(22)	5.6799	6.4711	93.7	B1V	
CD−51 9984	314529804	16 18 22.91	-51 26 24.27	EB+bCep	10.59	10.25	9.79258(3)	1632(6)	5.7444	5.9179	11.6	B0.5III	
CPD−41 7746	339570153	16 54 29.49	-41 39 14.95	EB+bCep	9.47	9.24	6.3467(3)	1633.57(10)	8.3307	1.8749	56.8	B0.5V	
CPD−45 3109	28957011	08 49 35.49	-46 23 19.27	EB+bCep	9.796	9.58	2.7139(1)	1519.1(2)	5.1874	11.7612	56.4	B2/4	
EO Aur	408937625	05 18 21.07	+36 37 55.36	EB+bCep	7.90	7.83	4.06550(3)	1830.47762(5)	12.1462	0.7569	40.7	B5	SWB22a
HD 108628	450918869	12 29 06.03	-62 28 00.15	EB+bCep	10.04	9.76	4.222(5)	1600.47(7)	6.7419	2.3420	46.9	B2II	
HD 112026	436382800	12 54 18.43	-60 53 38.93	EB+bCep	8.69	8.66	43.205(1)	1622.06(20)	6.3869	2.2215	46.9	B0/1IV	
HD 112485	437617380	12 57 51.50	-60 48 56.08	EB+bCep	9.57	9.53	5.372(1)	1604.95(90)	9.4393	1.1562	20.3	B1/3(III)	IJ21
HD 113742	440817830	13 06 53.75	-61 56 38.01	EB+bCep	9.53	9.2	15.68844(8)	1600.43(10)	6.9361	0.6593	10.1	B1/2(III)	
HD 143605	427406031	16 04 15.99	-56 26 27.39	EB+bCep	9.225	9.148	2.2077(2)	1627.96(2)	4.9630	0.2016	5.2	B3V	
HD 150927	78636551	16 45 44.06	-38 10 02.80	EB+bCep	9.68	9.42	14.33(2)	1629.95(20)	4.8433	116.9907	186.0	B2/3Ib	PP08
HD 151791	246552414	16 51 35.18	-44 29 35.79	EB+bCep	9.73	9.5	3.9173(1)	1631.97(20)	5.2269	0.6824	25.2	B2/3Ib/II	
HD 152268	339680203	16 54 16.59	-40 58 59.25	EB+bCep	8.97	8.98	3.4229(5)	1630.75(10)	10.0996	1.1891	35.9	B1/2Ib/II	IJ21
HD 157400	158688754	17 24 36.89	-35 50 19.75	EB+bCep	10.1	9.68	8.4527(4)	1630.5(2)	11.8628	1.2172	20.3	B3/5	
HD 188891	171502734	19 55 44.76	+40 23 30.25	EB+bCep+SPB	7.29	7.3	161.25	1731.0(4)	4.9713	0.6726	5.3	B1V	IJ21
HD 227877	91111448	20 08 23.07	+35 27 33.48	EB+bCep	9.37	9.30	1.70664(4)	1683.68(5)	13.2182	0.8809	36.2	B1:IV:nn	C22
HD 254346	426520557	06 16 57.32	+22 11 41.96	EB+bCep	10.13	9.74	5.4316(1)	2478.5(2)	9.2399	0.2559	23.6	B2:III:	LB20
HD 303115	458263480	10 38 33.37	-59 21 31.65	EB+bCep?	10.57	10.3	4.618(1)	2286.35(50)	5.7397	8.6545	181.9	OB-/B5	
HD 329379	122314621	17 01 05.87	-45 42 04.24	EB+bCep+SPB+ELL	10.7	9.83	2.2464(4)	1631.0(3)	6.3086	3.3545	53.3	B0II	
HD 339003	10891640	19 51 02.86	+25 57 15.43	EB+bCep	10.43	9.93	6.163(2)	1685.1(2)	6.7993	12.5707	43.1	B0.5III	LB20
HD 344880	451932686	19 45 42.31	+23 59 04.03	EB+bCep	9.96	9.34	54.49399(1)	1683.6(4)	9.4923	1.8301	32.9	B0.5III:nn	LB20
HD 92024	458076434	10 36 08.33	-58 13 04.36	EB+bCep?	8.9	9	8.3249(8)	2285.135(40)	7.1635	5.5897	41.4	B1III	F05
HD 96355	466528132	11 05 26.38	-61 26 04.20	EB+bCep	9.87	9.74	4.360(2)	1574.336(20)	6.3503	0.2568	16.7	B0/1(III)	IJ21
λ Sco	465088681	17 33 36.52	-37 06 13.76	EB+bCep	1.49	1.63	5.949(1)	1635.023(30)	4.6803	6.6404	49.6	B2IV+DA7.9	SWB22a
HQ CMa	106830354	07 20 54.92	-26 57 49.81	EB+bCep/SPB	5.816	5.986	–	–	–	–	–	B3V	SWB22a
LS I +61 145	406965391	00 22 26.52	+61 49 39.75	EB+bCep	11.3	10.9	1.84633(5)	1767.71(10)	7.5401	0.2860	9.9	B1V	IJ21
LS I +63 36	359042331	00 05 00.85	+63 49 33.21	EB+BCep+DSCT?	11.52	11.06	–	1782(12)	4.3199	1.0529	10.0	B0V	
TYC 3699-160-1	245470639	02 35 50.71	+58 35 20.83	EB+bCep+SPB	13	12.33	3.0687(9)	1794.42(10)	5.8189	2.0273	20.8	B0	
TYC 4050-2830-1	458879750	02 22 45.39	+62 25 36.98	EB+bCep+SPB	11.77	11.53	11.039(6)	1799.506(9)	9.2394	0.5669	13.4	B3	
CZ Vel	355656323	09 10 44.46	-50 42 40.61	EB+bCep	11.57	10.8	5.1929(1)	1519.35(20)	4.5871	2.9408	33.4	B2III/B6	DK04
EK Cru	379012185	12 02 58.47	-62 40 19.23	EB+bCep+ SPB	8.1	8.11	4.7447(1)	1572.36(10)	6.1436	0.5408	41.2	B1V	OW05
LR Ara	447530589	16 53 37.19	-61 35 11.27	SPB?+bCep+EB	10.6	10.7	1.5195(3)	1626.92(22)	4.4982	0.6199	7.5	B2	BD80
V1061 Cen	334443373	14 14 56.81	-61 14 18.42	EB+bCep	9.71	9.56	2.2096(3)	1600.68(10)	10.1423	0.2172	9.3	B2II/III	OT03
V1166 Cen	443262289	13 15 51.32	-63 53 03.32	EB+bCep	8.84	8.81	13.4551(3)	1604.35(20)	10.1551	1.1749	24.2	B1/2V	AG12
V1216 Sco	247315421	16 54 57.71	-43 56 27.17	EB+bCep	10.93	10.17	3.9213(6)	1632.95(15)	5.5517	10.6175	38.2	B0	OT03
V536 Mon	23548300	07 13 55.57	-02 54 29.87	EB+bCep+SPB	9.29	9.41	6.1341(3)	1493.21(20)	6.5405	0.4399	20.1	B3/4III	K68
VZ Cen	304803692	11 52 28.76	-61 31 26.93	EB+bCep	8.36	8.36	4.92870(2)	1574.95(20)	6.0303	3.8833	67.1	B2III/IV	IJ21
V2107 Cyg	42244951	20 08 45.77	+37 14 13.36	EB+bCep/SPB	8.73	8.63	4.2846(4)	1712.70759(6)	4.2008	3.4325	25.3	B1III	SWB22a
V4386 sgr	60433558	18 14 42.14	-33 08 27.22	EB+bCep	8.3	8.44	10.798(1)	1664.20(20)	6.7726	7.6322	78.8	B1II	PP08, C22
V453 Cyg	90349611	20 06 34.97	+35 44 26.27	EB+bCep	8.52	8.40	3.8900(4)	1684.2(1)	4.9459	3.0541	47.7	B0.4IV+B0.7IV	SW20
V916 Cen	322078735	11 42 25.35	-62 28 37.47	EB+bCep	9.68	9.63	1.46322(5)	1573.1113(60)	4.4514	13.2449	66.7	B0.5IVne	PP08
VV Ori	50897998	05 33 31.45	-01 09 21.86	EB+bCep+SPB	5.16	5.34	1.4853(2)	1468.45(10)	9.1788	1.4822	18.9	B1V+B4.5V	SW21

Note—References: (L10) Lee (1910), (J80) Jerzykiewicz (1980), (W51) Walker (1951), (IJ21) IJspeert et al. (2021), (SWB2a) Southworth & Bowman (2022a), (C22) Chen et al. (2022), (LB20) Labadie-Bartz et al. (2020), (F05) Freyhammer et al. (2005), (DK04) Dvorak (2004), (OW05) Otero & Wils (2005), (BD80) Brancewicz & Dworak (1980), (OT03) Otero (2003), (AG12) Alfonso-Garzón et al. (2012), (K68) Kukarkin et al. (1968), (PP08) Pigulski & Pojmański (2008), (SW20) Southworth et al. (2020) and (SW21) Southworth et al. (2021). SA00, BM22 and G86 in Table 2 refer to Shibahashi & Aerts (2000), Bowman et al. (2022) and Golay et al. (1986) respectively. These authors classified the stars either as eclipsing binary or β Cep pulsator or both. The details of their classification and other brief information about the stars are given in Appendix A denoted as A under remarks in the Tables 1-3.

AN Dor, EO Aur, HQ CMa, QX Car, V446 Cep and V2107 Cyg (Southworth & Bowman 2022a), and V1388 Ori Southworth & Bowman (2022b). However, some stars which were previously rejected are accepted in this paper. HD 254346, for instance, which was rejected by Labadie-Bartz et al. (2020) owing to blending with the δ Scuti pulsator HD 43385, 112 arc seconds away, is accepted as a β Cep star as we concluded that both HD 254346 and HD 43385 are pulsators with the former being a β Cep star. HD 329379 which was classified as an ellipsoidal variable with pulsating components by Steindl et al. (2021) is reclassified, in this paper, as a β Cep pulsator in an eclipsing binary with some ellipsoidal variations. On the other hand, LS CMa, HD 217919, FZ CMa and η Ori which were classified as β Cep candidate/definite pulsators in an eclipsing binary by Southworth & Bowman (2022a) and V Pup (Budding et al. 2021) were dropped as β Cep pulsators in this paper. The single pulsation frequency of LS CMa is in the domain of SPB rather than β Cep pulsations. The pulsations of HD 217919 appear in groups of harmonically related signals with the basic frequencies in the SPB domain. Hence we do not regard the higher frequency signals to be intrinsic (cf. Kurtz et al. 2015). FZ CMa appears to be a related case, with its pulsation spectrum dominated by a 2.7 c/d signal and possible harmonics and sub-harmonics. Also, the masses derived for the components of FZ CMa by Southworth & Bowman (2022a) are around 5 times the solar mass, which is too low for β Cep stars. There are stochastic light variations present in the light curves of V Pup and possible instrumental effects (saturation), but no coherent periodic variability apart from the eclipses was found. CW Cep (Lee & Hong 2021) is classified by us as a gravity-mode pulsator (see Appendix A). Eclipse removed light curves of η Ori show only a single frequency near 2.31 c/d and its first harmonic. We therefore reject it as a β Cep pulsator. In addition, several other objects (e.g. HD 277860) that have previously been identified as eclipsing binaries (e.g Golay et al. 1986) or β Cep pulsators (e.g. Hilt 1208) (Labadie-Bartz et al. 2020) only are now are reported to show both types of variability. A brief discussion of each of the pulsators is given in Appendix A.

A number of stars which were previously classified as β Cep pulsators in eclipsing binaries, but have spectral types outside the range defined by our selection criteria or have not been observed by *TESS* at the time of this work were not captured in detail in this analysis. These stars include CD−44 4484 – identified as β Cep candidate in an eclipsing binary by Labadie-Bartz et al. (2020), who recommended reanalysis of the target to confirm or disapprove it owing to their observation of shallow eclipses, V447 Cep - identified as β Cep by Stankov & Handler (2005) and eclipsing binary by Labadie-Bartz et al. (2020), CD−46 4432 - previously identified as a β Cep pulsating candidate but rejected by Labadie-Bartz et al. (2020) and HD 168050 - identified as β Cep in eclipsing binary by Pigulski & Pojmański (2008) but which has not been observed by *TESS*. At a more curious look at these targets, CD−44 4484 which has a spectral type B5, appears to be an eclipsing binary with β Cep pulsating component. V447 Cep turns out to be an eclipsing binary with ellipsoidal variations of different period, but no pulsations. CD−46 4432 which was rejected and its variability attributed to CD−46 4437 by Labadie-Bartz et al. (2020) appears to be the one pulsating instead. However, it has spectral type of B5 and beyond the spectral range analysed in this paper.

The number of confirmed β Cep pulsators in eclipsing binaries so far was fairly small. Using the *TESS* photometry, 78 definite and candidate β Cep pulsators in eclipsing binaries are reported in this work among which 45 are adjudged definite and 33 are candidate β Cep pulsator respectively. Nineteen of the 78 pulsators were already previously identified in literature as β Cep pulsators in eclipsing binaries, 22 identified as eclipsing binaries only and six identified as β Cep pulsators only. This results in 59 new discoveries in this work in which both variability (eclipsing binary and β Cep pulsation) are newly identified in 31 systems and single variability (eclipsing binary or β Cep pulsation) are newly identified in 28 stars. Ten ellipsoidal variables with β Cep pulsating components are also identified in this work with their β Cep variability newly identified in nine out of the ten.

4.2. *Periodicities of the pulsators*

The orbital periods of the stars and their analytical uncertainties are given in Tables 1 – 4. In cases where the Phoebe estimator (Prša et al. 2016) gives results that do not truly represent the period, the orbital period was obtained using the *Period04* (Lenz & Breger 2005) during prewhitening. Where there are already established precise periods, in literature, we adopted them after checking their validity for the times of *TESS* observation. For stars with incomplete orbital cycles in the 30-minute light curve, we determined the periods with the 2-minute cadence light curves if available. Where there is no light curve with a complete orbital cycle in both cadences (2-minute and 30-minute), a lower limit to the period is adopted. In such a case, the period would be more reliably obtained using their spectra. The analytical uncertainties of the periods were estimated using the *Period04* program. We obtained an orbital period range of 1.4074–161.25 d for our sample of pulsators of 80 definite and candidate β Cep pulsators. However, more than 80% of the sample has orbital periods below 20 d.

Period changes and modulations are usually examined via eclipse timings and O-C diagrams. However, the time span of the *TESS* data, which is in most cases only one or two months, makes it unreliable to compute them as they are too short to show any period change. As a result, the eclipse timings and O-C diagrams are not computed. Nevertheless, we computed the epochs of the binary light curve by estimating the time of minimum (i.e. the midpoint) of the primary eclipse, which in binary star analysis can also be referred to as the time of superior conjunction (t_supconj).

5. CONCLUSION

In this paper, we conducted a search for β Cep pulsators in eclipsing binaries in a sample of 8055 stars of spectral type B0–B3 using the *TESS* QLP and 2-minute cadence data. The result of the photometric and pulsation analyses indicates a total of 78 pulsators in eclipsing binaries in which 45 are recognized as definite and 33 are candidate pulsators after accounting for blends and removal of false positives. We computed the orbital ephemerides and tabulated the dominant pulsation frequencies with their amplitudes and S/N. We further crossmatched our results with the results

Table 2. List of candidates for β Cep pulsators in eclipsing binaries with their orbital ephemerides and dominant pulsation frequencies.

ID	TIC ID	RA	Dec	Class of Variability	Mag B	Mag V	P_{orb} (d)	T_0 (BTJD)	f_{puls} (c/d)	a_{puls} (mmag)	S/N	Spec. type	Ref.
23 Ori	264592553	05 22 50.00	+03 32 40.05	EB+bCep?	4.86	5	4.56(1)	1470.805(20)	11.7727	1.9010	43.9	B2IV/V	IJ21
β Cep	321818578	21 28 39.59	+70 33 38.57	EB+bCep?	3.01	3.23	4.6083(9)	2856.233(50)	5.2496	13.7388	37.3	B0.5IIIs	SA00, BM22
AN Dor	220430912	04 52 28.24	-55 41 49.41	EB+bCep/SPB?	7.47	7.69	2.032671(3)	2155.71301(1)	3.2028	1.2072	27.4	B2/3V	SWB22a
CD−28 5247	130348163	07 59 44.31	-29 00 55.16	EB+bCep?	11.75	11.33	4.256(2)	1495.362(20)	4.9761	0.5289	8.9	B0V/Obe	
CD−32 4839	144535458	08 05 56.85	-33 00 21.91	EB+bCep?	12.21	11.57	4.1317(5)	2229.6(6)	5.0968	1.0016	9.8	B2/4	
CD−32 4971	145760541	08 12 21.08	-32 35 03.34	betCep?	11	10.7	8.787(2)	2232.5(3)	5.3263	1.6852	19.6	B1IV	
CD−44 4813	28699677	08 46 53.39	-44 43 20.06	EB+bCep?	11.29	10.74	22.9444(5)	1548.92(30)	4.4475	0.2992	7.7	B2/5	
CD−57 3146	463899225	10 19 12.87	-58 26 01.03	EB+bCep?	10.77	10.73	23.283(8)	1564.925(23)	5.0817	1.8439	28.9	B3/4	IJ21
GSC 04052-01378	390515222	02 53 08.35	+62 06 10.49	EB+bCep?	–	11.7	18.310(6)	1798.018(10)	3.0631	5.0276	36.1	B2	
HD 101838	321947833	11 42 49.28	-62 33 54.98	EB+bCep?	9.56	9.55	5.40985(5)	1574.645(10)	3.1277	10.7272	19.52	B0.5/1III	
HD 135477	455667423	15 18 06.61	-60 05 38.91	EB+bCep+SPB?	8.15	8.2	2.0079(3)	1626.205(60)	5.8949	0.2239	5.9	B2V	IJ21
HD 138112	284374921	15 32 54.50	-59 48 26.29	EB+bCep?	9.63	9.51	21.037(6)	2345.70(20)	5.1562	2.5284	4.39	B2IV-V/B5	
HD 13969	264613302	02 17 49.85	+57 05 25.58	EB+bCep	9.15	8.0183	16.305(5)	2887.34(50)	7.1265	0.6234	19.0	B0.5I	
HD 151083	51288359	16 47 51.39	-51 46 04.05	EB+bCep?	10.08	9.54	1.8016(4)	1632.945(50)	6.2416	1.9947	16.2	B2Vn	
HD 154407	42424196	17 06 47.90	-35 53 15.07	EB+bCep?	9.12	8.83	2.5592(4)	1631.54(10)	12.9677	0.3458	10.6	B2Vn	
HD 155274	45731009	17 11 57.77	-35 00 26.32	EB+bCep+SPB?	10.14	9.73	6.896(7)	1629.9744(50)	10.1432	1.1499	37.6	B2/5(n)	
HD 1743	428415975	00 22 03.41	+62 11 06.29	EB+bCep?	8.43	8.33	11.7950(5)	1801.35(36)	8.7933	0.2418	12.9	B0.2IV	IJ21
HD 240171	314034024	23 02 44.51	+57 08 33.51	EB+bCep?	10.02	9.92	5.1514(9)	1630.75(10)	7.6528	1.2996	37.8	B1V	
HD 277680	122883754	05 10 17.68	+40 39 35.26	EB+bCep?	8.93	8.89	4.3207(5)	1818.8(2)	8.4876	0.9536	28.0	B3	G86
HD 306124	466887289	11 08 51.19	-61 21 10.48	betCep?	10.89	10.68	1.4074(8)	2310(4)	5.5449	0.1162	4.9	B3	
HD 46060	25041731	06 30 49.81	-09 39 14.80	EB+bCep?	9.03	8.82	20.6094(8)	1474.22(20)	13.9797	0.4237	30.2	B2II	
HD 73903	141497319	08 38 58.88	-46 13 37.55	EB+bCep?	9.19	9.05	2.8093(2)	1520.19(20)	4.2521	15.1962	94.9	B3II	
HD 76838	30562668	08 57 07.55	-43 15 22.27	EB+bCep	7.31	7.31	3.8522(2)	1518.08(40)	8.7329	2.8359	93.9	B2IV	C22
HD 92741	458561474	10 41 12.35	-59 58 25.04	EB+bCep	7.22	7.25	5.373(2)	1574.57(20)	4.9674	2.7207	47.7	B1/2II	
HD 92782	458599043	10 41 30.95	-57 30 51.61	EB+bCep?	9.62	9.51	14.46(2)	2287.375(20)	6.5258	12.0216	65.9	B1/2(III)	
Hilt 1208	269228628	23 17 13.69	+60 00 27.93	EB+bCep?	11.35	10.9	2.422(1)	2856.38(4.00)	4.9921	8.0405	120.4	B2	LB20
LS VI -04 19	33091633	06 59 30.23	-04 48 43.82	EB+bCep?	11.1	10.81	7.520(4)	1495.83(30)	10.5639	0.5088	20.5	B0IV	
NGC 2483 2	129364361	07 55 43.58	-27 54 05.42	EB+bCep+SPB?	12.46	12.16	4.767(5)	1493(3)	4.1621	1.9193	11.56	B3:	
QX Car	469247903	09 54 33.88	-58 25 16.58	EB+bCep?	6.47	6.64	4.47800(2)	1546.32(10)	5.7216	0.1346	5.5	B2V	SWB22a
TYC 8995-5052-1	314139276	13 30 00.85	-63 38 04.24	EB+bCep?	11.77	11.43	4.73(1)	1665.5301(40)	5.8964	12.4115	16.9	B2III	
V1388 Ori	337165095	06 10 59.17	+11 59 41.48	EB+bCep+SPB?	7.44	7.50	2.1870301(8)	2485.226609(16)	3.9987	0.18	5	B2V	SWB22b
V446 Cep	335265326	22 08 45.59	+61 01 20.71	EB+bCep?	7.4	7.32	3.808386(6)	1767.0005(1)	10.2438	1.2801	93.5	B1V	IJ21,SWB22a
V964 Sco	339567760	16 54 18.32	-41 51 35.65	EB+bCep?	9.776	9.603	5.2179(5)	2366.63(20)	11.3812	1.7047	23.4	B0.5V	

Table 3. List of ellipsoidal variables with β Cep pulsating components

ID	TIC ID	RA	Dec	Class of Variability	Mag B	Mag V	P_{orb} (d)	f_{puls} (c/d)	a_{puls} (mmag)	S/N	Spec. type	Ref.
BD+48 658	301263808	02 23 23.60	+49 01 55.41	EB/ELL+BCep	8.65	8.76	2.955(2)	6.1044	1.7383	37.7	B2	
HD 13338	347486043	02 12 19.17	+57 56 27.17	ELL/ROT+bCep	9.38	9.17	–	4.6372	5.8279	11.8	O9.5V/B1III	
HD 232874	266338052	04 02 15.74	+53 45 11.78	EB/ELL+bCep	9.26	8.92	1.5174(8)	5.7395	7.5950	11.2	B0.5V	LB20
HD 277132	121064859	04 56 27.87	+41 16 18.94	EB/ELL/ROT+bCep	11.58	11.23	2.4291(4)	4.6207	0.6815	9.3	B3	
HD 300978	458604640	10 41 55.77	-56 42 51.88	EB/ELL/ROT+bCep	9.66	9.61	4.787(8)	7.6876	1.6896	31.2	B3	
HD 308106	465870314	10 58 11.89	-62 09 36.41	ROT/ELL/EB+bCep	10.77	10.65	1.8837(6)	13.7095	0.3660	6.6	B3	
HD 327010	382486122	17 11 42.98	-42 52 02.75	bCep+ELL?	10.36	9.8	7.5537(6)	4.7824	2.4827	27.8	B3	
HD 39716	66975228	05 54 03.33	-06 45 08.27	ELL?+SPB?+bCep?	8.5	8.52	2.4903(3)	5.4376	0.3982	24.9	B3III	
HD 55687	178374964	07 13 34.03	-10 29 25.34	EB/ELL+SPB?+bCep	9.27	9.34	1.211(1)	7.8176	0.3545	7.6	B3II/III	
NGC 6913 82	14621767	20 24 50.37	+38 18 34.60	EB+bCep	12.96	11.53	2.0499(1)	6.9686	2.4598	34.9	B2IV	

of previous searches. Among the 78, 59 are new discoveries as 19 have been previously identified as β Cep pulsators in eclipsing binaries. 22 stars have also been previously identified as eclipsing binaries only and 6 as β Cep pulsators only. The number of pulsators in our sample accounts for about 1% of the sample and contributes about 59 new definite β Cep pulsators and candidates in eclipsing binaries to the pool already discovered to date. There are also 10 possible ellipsoidal variables with pulsating components in our sample. This work provides a bigger sample for a more general and homogeneous in depth asteroseismic analysis of β Cep pulsators. It will provide the needed constraints to better calibrate the internal mixing profile and possibly resolve the mass discrepancy in massive stars via the combined strengths of binary and asteroseismic modelling.

Table 4. List of rejected targets

ID	TIC ID	RA	Dec	Mag B	Mag V	Period (d)	Spec. type	
η Ori	4254645	05 24 28.62	-02 23 49.73	3.18	3.35	7.989(3)	B1V+B2	
BD+61 675	84342607	04 07 44.08	+62 18 04.13	10.16	9.61	2.699(7)	B1Vn	
CD−59 4169	383089500	12 14 33.31	-60 24 40.92	11.15	10.72	2.97154(9)	B1V	
CPD−59 3141	467066902	11 11 14.84	-60 29 51.08	11.25	11.06	11.5089(4)	B2	
CW Cep	434893323	23 04 02.23	+63 23 48.72	7.97	7.6	2.72914(3)	B1.5Vn	
FZ CMa	125497512	07 02 42.61	-11 27 11.57	8.28	8.14	1.2733(3)	B2IVn	
HD 153772	212415990	17 04 01.23	-51 05 01.15	8.38	8.32	-	B2V	
HD 154646	380870688	17 09 01.58	-46 16 38.61	EB+bCep	9.96	9.64	13.0298(1)	B2II
HD 217919	434723918	23 03 01.47	+63 41 53.35	8.75	8.2	16.2080(9)	B3	
HD 308111	465869053	10 57 54.75	-62 17 35.73	10.62	10.59	2.4396(5)	B2	
LS II +23 34	360661624	19 44 21.08	+23 17 05.90	12.3	11.82	10.2572(2)	B	
LS CMa	63427664	07 01 05.95	-25 12 56.28	5.47	5.64	> 10	B2/3III/IV	
V Pup	269562415	07 58 14.44	-49 14 41.68	4.24	4.41	1.45453(3)	B1Vp+B2	

6. ACKNOWLEDGMENTS

This work was supported by the Polish National Science Foundation (NCN) under grant nr. 2021/43/B/ST9/02972. This paper used the *TESS* data obtained from the Mikulski Archive for Space Telescopes (MAST). Support to MAST for these data is provided by the NASA Office of Space Science via grant NAG5-7584 and by other grants and contracts. Funding for the *TESS* mission is provided by the NASA Explorer Program. This paper also made use of the SIMBAD data base and the VizieR catalogue access tool, operated at CDS, Strasbourg, France; the SAO/NASA Astrophysics Data System. It also made use of data from the European Space Agency (ESA) mission *Gaia* (https://www.cosmos.esa.int/gaia), processed by the *Gaia* Data Processing and Analysis Consortium (DPAC, https://www.cosmos.esa.int/web/gaia/dpac/consortium). Funding for the DPAC has been provided by national institutions, in particular the institutions participating in the *Gaia* Multilateral Agreement.

Facilities: *TESS*

Software: python, period04 (Lenz & Breger 2005), eleanor (Feinstein et al. 2019; Brasseur et al. 2019), *TESS*-Localize (Higgins & Bell 2022)

APPENDIX

A. SHORT REMARKS ON INDIVIDUAL STARS

A.1. *β Cep pulsators in eclipsing binaries*

16 Lac = TIC 129538133: It was discovered to be a spectroscopic binary by Lee (1910), a pulsating star by Walker (1951) and an eclipsing binary by Jerzykiewicz (1980). Detailed studies of the star to determine its orbital and absolute parameters have been undertaken by a number of authors (e.g. Lehmann et al. 2001; Southworth & Bowman 2022a). An asteroseismic analysis of the pulsating component was conducted by Thoul et al. (2003).

BD+44 3594 = TIC 353099086: this is a Be star with a long orbital period. Although it has a long period variable candidate 59.79 arc seconds away, there is no indication of a significant blending effect. It shows both β Cep and SPB pulsations. The binarity and the pulsations are reported for the first time in this work.

BD+44 3664 = TIC 330081196: This star has its spectral type classified as B1Vn by Straizys et al. (1989). It is an eclipsing binary with β Cep pulsations and has some nearby Gaia sources which could contaminate the light curve. However, the CROWDSAP parameter for this object is 0.89624, suggesting that the signals most likely originate from the target. The binarity and the pulsations are newly identified in this work.

CD−38 4128 = TIC 134522557: This star has no significant nearby contaminator. It has been observed in *TESS* sectors 6, 7, 34,35, 61 and 62 using *TESS* camera 3. The binarity and the pulsations are newly reported in this work. There are still a number of pulsations left in its phase diagram shown in Figure 3.

CD−51 9984 = TIC 314529804: Classified as a B0.5III star in the spectral classification and photometry of southern B stars compiled by Feast et al. (1961). This star has a neighbour, TIC 314529900, which is 1 magnitude brighter at 76.18 arc seconds from it and claimed an eclipsing binary star (IJspeert et al. 2021). The available *TESS* photometry of the latter star does however not show any eclipses. Therefore, we suggest that the eclipses and pulsational signals we observed emanate from CD−51 9984.

CPD−41 7746 = TIC 339570153: There are many faint nearby sources within the aperture mask. The CROWDSAP parameter for this object is 0.89506, suggesting that the variability signals most likely originate from the target.

CPD−45 3109 = TIC 28957011: This star has no nearby contaminant. The binarity and the pulsations are reported for the first time in this work.

EO Aur = TIC 408937625: It was discovered to be eclipsing by Gaposchkin (1943) and to be β Cep pulsator by Southworth & Bowman (2022a). It contains two early-B stars in a 4.07 d orbit (Southworth & Bowman 2022a).

HD 108628 = TIC 450918869: It was discovered to be a β Cep pulsator by Pigulski & Pojmański (2008). These authors, however, treated it as an isolated single star as no eclipses seem to have been detected by them. However the *TESS* QLP light curve shows primary eclipses of 18 mmag depth.

HD 112026 = TIC 436382800: Although there is a nearby star TIC 436373277 = HD 312121, which could possibly modulate the light curve, the pulsational signals we observed are traced to HD 112026. The CROWDSAP parameter for the target is also 0.96683, and the amplitude of the dominant pulsation is 2.22 mmag. The orbital period of some 43 d is rather long and the orbit is clearly eccentric. The binarity and the pulsations are reported for the first time in this work.

HD 112485 = TIC 437617380: It was identified as an eclipsing binary in the catalogue of OBA-type eclipsing binaries observed by *TESS* compiled by IJspeert et al. (2021). Our analysis suggests that there is no significant contamination from TIC 437612835, which is an A0 star 89.69 arc seconds away. However, the frequency range of its pulsational frequency spectrum (3.4–9.5 c/d) is unusually wide for a β Cep star.

HD 113742 = TIC 440817830: This star has a relatively long orbital period of 15.688 d and an eccentric orbit. There is a nearby G3V star, with a similar *TESS* magnitude, at 106.85 arc seconds from it. However, our blending analysis suggests that the detected light variations come from HD 113742. The eclipses and pulsations are reported for the first time here.

HD 143605 = TIC 427406031: Although there is a long period variable 80.72 arc seconds away (3.4 mag fainter than the target in the *TESS* passband), our blending analysis suggests that the signals emanate from HD 143605. The pulsation is of low amplitude, but significantly present in the data.

HD 150927 = TIC 78636551: It was discovered to be a β Cep variable by Pigulski & Pojmański (2008). The *TESS* light curves imply the presence of eclipses with depths of about 0.04 mag and a 14.33 d period within the high-amplitude pulsations (the orbital period could be that or twice that value). The dominant pulsation frequency appears to be within an unresolved multiplet, hence our determination of its amplitude is uncertain (but in relatively good agreement with Pigulski & Pojmański (2008)).

HD 151791 = TIC 246552414: Two stars, which are about 2.5 magnitude fainter than the target are found within 36 arc seconds from the target. Our blending analysis suggests that the signals are consistent with location of the brightest star, but not uniquely so. The star 36" away also seems to be a hot pulsating star. The eclipses and pulsations are reported for the first time here.

HD 152268 = TIC 339680203: also identified as eclipsing binary in the catalogue of OBA-type eclipsing binaries observed by *TESS* compiled by IJspeert et al. (2021). Its β Cep variability is, however, newly identified in this work.

HD 157400 = TIC 158688754: This star has no nearby contaminant. The binarity and the pulsations are reported for the first time in this work.

HD 188891 = TIC 171502734: The catalogue of *Kepler* eclipsing binaries (Kirk et al. 2016) lists this system with a period of 161.25 d. Pulsations are present at very low amplitude in both the SPB and β Cephei frequency regions, both in the *Kepler* and *TESS* data.

HD 227877 = TIC 91111448: It was discovered to be eclipsing by IJspeert et al. (2021) and to be a β Cep pulsator by Chen et al. (2022). However, its orbital period was not computed by these authors. We obtained a period of 1.70664(4) for the system.

HD 254346 = TIC 426520557 was rejected by Labadie-Bartz et al. (2020) as a β Cep pulsator owing to blending with the δ Scuti pulsator HD 43385, 112 arc seconds away from it. However, it is accepted as β Cep in this paper as the *TESS* photometry allows us to conclude that both HD 254346 and HD 43385 are pulsators with the former being a β Cep star.

HD 303115 = TIC 458263480: there are many faint sources in the field with the closest at 70.19 arc seconds. Our analysis of possible contamination suggests that both the eclipses and the pulsations come from the target.

HD 329379 = TIC 122314621: Steindl et al. (2021) classified it as an ellipsoidal variable that also shows pulsations. We suggest those to be of the β Cephei type. The pulsation amplitudes are enhanced near the ellipsoidal light minima, suggesting interplay between the pulsations and tidal forces. A phase diagram of the pulsation-removed orbital light curve shows the presence of shallow eclipses.

HD 339003 = TIC 10891640: It was discovered to be a β Cep pulsator in an eclipsing binary by Labadie-Bartz et al. (2020), who also noticed a reflection effect in the light curve. This is corroborated by the *TESS* photometry.

HD 344880 = TIC 451932686: also this star was discovered to be a β Cep pulsator in an eclipsing binary by Labadie-Bartz et al. (2020) which is confirmed by our analysis of its *TESS* photometry. It has a long orbital period of 54.494(2) d as determined by the above mentioned authors.

HD 92024 = TIC 458076434: It is a known β Cephei pulsator in an eclipsing binary, e.g., see Freyhammer et al. (2005).

HD 96355 = TIC 466528132: Also discovered to be an eclipsing binary by IJspeert et al. (2021) in their catalogue of OBA-type eclipsing binaries observed by *TESS*. A source 4.1 mag fainter than the target in the *TESS* band is at 38.58 arc seconds from it. However, the pulsational signals appear to originate from HD 96355.

HQ CMa = TIC 106830354: It was discovered to be eclipsing by Jerzykiewicz & Sterken (1977) and as a β Cep and SPB candidate by Southworth & Bowman (2022a). The orbital period is unknown as there is no agreement in the literature about it. In this work, we also could not unambiguously determine this period. Pulsations are found both in the SPB and β Cep frequency domains.

λ Sco = TIC 465088681 is a multiple system with an inner eclipsing binary and a tertiary component. The inner eclipsing binary is composed of a B-star of mass 10.4 ± 1.3 solar mass showing β Cep pulsations and a $1.6 - 2.0$ solar mass unresolved main sequence star (Southworth & Bowman 2022a). Detailed analyses of the system can be found over a wide range of literature (e.g De Mey et al. 1997; Handler & Schwarzenberg-Czerny 2013).

LS I +61 145 = TIC 406965391: Also identified as an eclipsing binary in the catalogue of OBA-type eclipsing binaries observed by *TESS* compiled by IJspeert et al. (2021). Its β Cep variability is, however, newly identified in this work.

LS I +63 36 = TIC 359042331: A faint star TIC 359042198 with a magnitude difference of 4.86 in G band is 109.94 arc seconds away from the target. The *TESS* light curves of TIC 359042331 show primary eclipse depth of 34.5 mmag, secondary eclipse depth of 18 mmag and the amplitude of the dominant pulsation of 1.05 mmag. Considering the magnitude difference between the stars, it is not evident that the contaminator could have caused the signals of such amplitude. We therefore conclude that both the eclipses and pulsations originate from TIC 359042331.

TYC 3699-160-1 = TIC 245470639: Both β Cephei and SPB pulsations as well as a reflection effect are present. A star 0.3 mag fainter than the target in the *TESS* band at 69.89 arc seconds distance is present, but both the β Cep pulsations and the eclipses arise from the target.

TYC 4050-2830-1 = TIC 458879750: There is no nearby contaminator strong enough to significantly modulate the light curve. Both β Cephei and SPB pulsations are present.

CZ Vel = TIC 355656323 was classified as an eclipsing binary by Dvorak (2004). Pulsations are reported here for the first time.

EK Cru = TIC 379012185 was identified as an eclipsing binary by Otero & Wils (2005); pulsations (both of the SPB and β Cephei type) are reported here for the first time.

LR Ara = TIC 447530589: This star was catalogued as an eclipsing binary by Brancewicz & Dworak (1980). Although there is a contaminator 31.26 arc seconds away, which is about 3 magnitude fainter, there is no indication that the signals come from the contaminator: the eclipses are too deep that they could be caused by blending with this star which is also too cool to pulsate with the observed periods. Pulsations (both of the SPB and β Cephei type) are reported here for the first time.

V1061 Cen = TIC 334443373: Otero (2003) classified it as eclipsing binary. Pulsations are reported here for the first time.

V1166 Cen = TIC 443262289 was first classified as an eclipsing binary by by Alfonso-Garzón et al. (2012) and corroborated by IJspeert et al. (2021) in their catalogue of OBA-type eclipsing binaries observed by *TESS*. Pulsations are reported here for the first time.

V1216 Sco = TIC 247315421: It was identified as an eclipsing binary by Otero (2003). Pulsations are reported here for the first time.

V536 Mon = TIC 23548300: The binarity was first identified by Kukarkin et al. (1968) and corroborated by a number of authors e.g. Kreiner (2004). It also has an eccentric orbit. Pulsations of both the β Cep and SPB types are reported here for the first time.

VZ Cen = TIC 304803692: It was first identified as an eclipsing binary by Alfonso-Garzón et al. (2012). Pulsations are reported here for the first time.

V2107 Cyg = TIC 42244951: Also discovered to be eclipsing binary by Kazarovets et al. (1999) using *Hipparcos* satellite data and as a β Cep pulsator by Southworth & Bowman (2022a). Rotational splitting and tidally perturbed modes are also suspected by the latter authors.

V4386 Sgr = TIC 60433558: It was first discovered to be eclipsing by Pigulski & Pojmański (2008), corroborated by Avvakumova et al. (2013) and also as a β Cep pulsator by Pigulski & Pojmański (2008) and corroborated by Chen et al. (2022).

V453 Cyg = TIC 90349611: This eclipsing system has an orbital period of 3.89 d, an eccentric orbit and exhibits apsidal motion (Wachmann 1973). Its β Cep pulsations were analysed by Southworth et al. (2020), who also reported tidally perturbed pulsations in the system.

V916 Cen = TIC 322078735: This star was discovered to be a β Cep pulsator in an eclipsing binary with an orbital period of 1.463 d by Pigulski & Pojmański (2008). The *TESS* photometry in this analysis confirms its variability type. It is also a Be star (Moffat & Vogt 1975), a member of the open cluster Stock 14 and shows other types of variability related to γ Cas and λ Eridani (Pigulski & Pojmański 2008). Although there could be significant third light contribution, the amplitude of the dominant β Cep pulsation is reasonably large (13.2 mmag) that we cannot conclude that it originates from the modulation of light curves by the contaminating light.

VV Ori = TIC 50897998: It was discovered to be an eclipsing binary with β Cep primary and an SPB secondary by Southworth et al. (2021). These authors also observed a changing orbital inclination which was adjudged to be driven by its dynamical interactions with a third body. This system was also among the five β Cep pulsators identified by Chen et al. (2022).

A.2. *Candidates for β Cep pulsators in eclipsing binaries*

23 Ori = TIC 264592553: This star was first identified as a spectroscopic binary by Eggleton & Tokovinin (2008) and as an eclipsing binary by IJspeert et al. (2021). In this work, we newly identify β Cep variability in this system. However, it is not clear whether the eclipses seen in the light curve come from 23 Ori or from HD 35148, 32" apart from the target.

β Cep = TIC 321818578: It has been studied extensively as a single star (Shibahashi & Aerts 2000; Bowman et al. 2022) as none of the authors had observed eclipses in its light curve. However, the *TESS* photometry shows shows shallow eclipses of 10 mmag in the QLP data and 20 mmag in sector 58 data, for instance. It is not certain that the eclipses involve the pulsating star. It could possibly come from β Cep B which is 13.38 arc seconds from it with a V magnitude of 8.63.

AN Dor = TIC 220430912: AN Dor was first discovered to be an eclipsing binary by Kazarovets et al. (1999) using the *Hipparcos* satellite and catalogued as a variable B-star in eclipsing binary by Percy & Au-Yong (2000), who pointed out that the short term variability is uncertain. Southworth & Bowman (2022a) using *TESS* data reported a total eclipse and a strong reflection effect, and also observed SPB and β Cep pulsations over a wide frequency range. We concur with this finding with the caveat that we cannot confidently rule out that the variations in the β Cep frequency domain are due to combination frequencies of the SPB pulsations.

CD−28 5247 = TIC 130348163: It has weak pulsations and blends (amongst others) with TIC 130348237 which could be the origin of the pulsational signals.

CD−32 4839 = TIC 144535458: We detected ellipsoidal light variations and shallow eclipses. There is a single possible β Cep pulsation mode, but given the presence of an optical component in 3 arc seconds distance 1.3 mag fainter than the target, we cannot be sure that they arise in the photometric binary.

CD−32 4971 = TIC 145760541: The star is an optical triple system and located in a crowded field. We cannot safely conclude that both the pulsational signals and the eclipses arise from one and the same object.

CD−44 4813 = TIC 28699677: This star has a long orbital period with weak pulsations that we cannot safely exclude to originate from some fainter star nearby.

CD−57 3146 = TIC 463899225: There are some blending issues with a few contaminators nearby. This object was discovered to be an eclipsing binary by IJspeert et al. (2021) in their catalogue of OBA-type eclipsing binaries observed by *TESS*. The pulsations which are suspected to originate from the target are reported in this work for the first time.

GSC 04052-01378 = TIC 390515222: We cannot exclude confidently that the weak pulsational signal detected arises in one of the neighbouring stars.

HD 101838 = TIC 321947833: Its variability was discovered by Pigulski & Pojmański (2008) and β Cep pulsations by Drobek et al. (2010). It was shown that the orbital period could be about 5.41167 or twice as much (Drobek et al. 2010). These authors however favoured twice of 5.41167 which could result in double eclipse of equal depths instead of single eclipse with 5.41167. In this paper, an orbital period of 5.41187(7) d was obtained from the *TESS* light curve. from the S10, 11, 37 and 38 data. Also, the pulsation frequencies of the star are all below $3.2\,\mathrm{cd}^{-1}$, making us suspect this is in fact a rapidly rotating SPB and not a β Cep star.

HD 135477 = TIC 455667423: It was also identified as an eclipsing binary in the catalogue of OBA-type eclipsing binaries observed by *TESS* compiled by IJspeert et al. (2021). The orbit is clearly eccentric. It has a faint long period variable, about 4 magnitude dimmer, at 29 arc seconds from it. Our analysis suggests that target has low amplitude pulsations both in the SPB and β Cephei frequency domains. As some (but not all) of the frequencies in the β Cephei range can be explained with combinations of the lower frequencies, we retain this system among the candidates instead of firm detections.

HD 138112 = TIC 284374921: It was identified as an eclipsing binary in the catalogue of OBA-type eclipsing binaries observed by *TESS* compiled by IJspeert et al. (2021). It has few contaminators nearby. The four brightest contaminators in the *TESS* band are three red giants and one A-type star. The eclipses are shallow and the pulsations are weak although in the β Cep domain.

HD 13969 = TIC 264613302: This star has a long orbital period of about 16 d and shallow flat bottomed eclipses of about 0.02 mag depth. The CROWDSAP parameter is 0.90977 and the amplitudes of the pulsations are below 0.6 mmag. We thus cannot be sure that both the pulsations and eclipses come from the target.

HD 151083 = TIC 51288359 was classified as a Be star by Balona & Ozuyar (2021). The shape of light curves resembles eclipses with a short period (1.8 or 0.9 d) with pulsations superposed. The features reminiscing eclipses cannot be fully distinguished from beating of multiple pulsation modes.

HD 154407 = TIC 42424196 is a visual double with TIC 42424192 that has almost identical basic stellar parameters. The pulsations and eclipses could thus arise from different objects, respectively, or from either of the two stars.

HD 155274 = TIC 45731009: It is 5.71 arc seconds away from another eclipsing binary, TIC 45731014 first identified by IJspeert et al. (2021). It is not clear where the variability observed in both is coming from: either both are eclipsing binaries or one is modulated by the other. We cannot rule out that IJspeert et al. (2021) misidentified the source of the eclipses. Also, the Gaia source located at the coordinates of TIC 45731014 which is a red star, is more than 6 magnitudes fainter than TIC 45731009.

HD 1743 = TIC 428415975: It was also classified as an eclipsing binary by IJspeert et al. (2021) in their catalogue of OBA-type eclipsing binaries observed by *TESS*. However, it blends with the nearby pulsating star TIC 428415927 which is 4 magnitudes fainter in the *TESS* passband. Given the low amplitude of the pulsation (0.18 mmag) this close-by star cannot be confidently excluded as their source.

HD 240171 = TIC 314034024: The amplitudes of the pulsation frequencies are similar to that of the suspected orbital variability with a 5.15-d period. The shape of the latter signal may be due to eclipses, although it appears rather reminiscent of a "heartbeat" star light curve. There are also nearby contaminators such that we cannot clearly identify the origin of the signals.

HD 277680 = TIC 122883754 was reported to be an eclipsing binary by IJspeert et al. (2021). However, it is sufficiently close to TIC 122883745 (6.27 arc seconds) with a magnitude difference of 2.3 in the *TESS* band such that it is not clear where the signals come from. The eclipses are shallow (40 mmag), so the 6" companion could be responsible, but the pulsations should come from the target as this companion is too cool.

HD 306124 = TIC 466887289: both the eclipses and the pulsational signals have very low amplitude. Hence we cannot exclude that they originate in some of the fainter close-by stars.

HD 46060 = TIC 25041731: The signals could come from more than one star as it blends with TIC 25041724 and TIC 25041738. It has a long orbital period of 20.6094(8) d.

HD 73903 = TIC 141497319: Jaschek & Egret (1982) classified it as a Be Star. There are many bright nearby stars, including CPD−45 2774 so that it is not clear where the signals come from.

HD 76838 = TIC 30562668: It was discovered to be eclipsing by IJspeert et al. (2021) and as a β Cep pulsator by Chen et al. (2022) using *TESS* photometry. There are several bright early type stars around this object, two classified in SIMBAD as eclipsing binaries. Although the nearest eclipsing binary to it is a faint Gaia source, the second (CD-42 4806) 46.13 arc seconds away is only about 1 magnitude fainter. There is much contamination that it is not clear if HD 76838 is the source of the observed variability.

HD 92741 = TIC 458561474 was also identified as an eclipsing binary in the catalogue of OBA-type eclipsing binaries observed by *TESS* compiled by IJspeert et al. (2021). The target has nearby stars. Examples include CPD-59 2451 and CD−59 3219B, which are 2 and 4.8 magnitudes fainter in the *TESS* band at 45 and 4.49 arc seconds respectively from it which could have possibly and significantly modulated the light curve.

HD 92782 = TIC 458599043: There are two relatively bright stars, HD 92758 (A6/7 V) and HD 303139 (M0) of almost similar magnitudes in V band with the target in its neighbourhood (less than 100 arc seconds). It is not clear whether both the pulsations and the eclipses originate from our target of interest. The phased eclipse light curve is somewhat asymmetric.

Hilt 1208 = TIC 269228628: It was first discovered to be a β Cep pulsator by Labadie-Bartz et al. (2020). However, these authors did not observe any eclipse in its light curve. The *TESS* photometry shows shallow eclipses of about 38 mmag depth. Whether that eclipse originates from it or is contributed by the gaia source 88.50 arc seconds from it with a magnitude difference of 5.71164 in G band is not yet established.

LS VI −04 19 = TIC 33091633: There is a nearby star TIC 33091617 that cannot be excluded to be the origin of the apparent pulsational signals. The brighter star HD 52047, 1.5' away from the target, is not.

NGC 2483 2 = TIC 129364361: This star is located in a dense field in an open cluster. The observed light curve is likely a superposition of the variability of several stars.

QX Car = TIC 469247903: It was discovered to be a spectroscopic binary by Thackeray et al. (1973), eclipsing by Cousins et al. (1969) and β Cep candidate by Southworth & Bowman (2022a). It has an orbital period of 4.47800(2) and dominant pulsation frequency of 5.7216 c/d at a S/N of 5.5. There is no significant contaminant in the aperture mask. Although we observed only a single β Cep pulsation mode from it, our analysis suggests that the pulsation originates from one of the similar components (Andersen et al. 1983) of the eclipsing binary.

TYC 8995-5052-1 = TIC 314139276 has an eccentric orbit, and few nearby sources that could contaminate the data. It is not clearly evident whether the signals originate from the early B-type star.

V1388 Ori = TIC 337165095: It was discovered to be a β Cep pulsator in an eclipsing binary by Southworth & Bowman (2022b). These authors described it as a detached eclipsing binary with two early-B type components that are significantly tidally distorted. They also reported two pulsation frequencies at 2.99 and 4.0 c/d, which we confirm together with some additional lower frequency variability. If there was a β Cephei pulsator in this system, it must be the more massive component, for which Southworth & Bowman (2022b) derived $M = 7.24\mathrm{M}_{\odot}$ and $R = 5.30\mathrm{R}_{\odot}$. This yields a pulsation constant $Q = 0.055$d, which is larger than the expected value for radial fundamental mode pulsation (see Stankov & Handler (2005) for a discussion). V1388 Ori could therefore be a pure g-mode pulsator.

V446 Cep = TIC 335265326 was discovered to be an eclipsing binary with an orbital period of 3.81 d by Kazarovets et al. (1999) using *Hipparcos* satellite data and reported as a β Cep pulsator by Southworth & Bowman (2022a). Although there is a long period variable 20.30 arc seconds away, their magnitude difference which is 6.210257 in the G band suggests that the contaminator would have at best a minimal effect on the light curve of the target. We cannot completely rule out that the pulsation frequencies in the β Cep domain are combination frequencies of the g mode signals.

V964 Sco = TIC 339567760: It belongs to the cluster NGC 6231 and has β Cep variability (Meingast et al. 2013). There are many possible contaminators from the cluster such that it is not certain both the eclipses and pulsations indeed come from the same star.

A.3. *Likely ellipsoidal variables with β Cep components*

BD+48 658 = TIC 301263808: This star is an ellipsoidal variable. There is no contaminator within the aperture mask for a 5 magnitude difference. The nearby bright star BD+48 661 does also not cause notable contamination, hence, the signals come from the target.

HD 13338 = TIC 347486043: It was identified as β Cep pulsator by Labadie-Bartz et al. (2020). Here, we report ostensible ellipsoidal variations in addition, but cannot confidently exclude a rotational origin. There is no significant contamination.

HD 232874 = TIC 266338052: The star could be an eclipsing or ellipsoidal variable with rotational modulation (Labadie-Bartz et al. 2020). These authors however also classified it as a β Cep pulsator. There could be some contamination from a nearby star 31.29 arc seconds away, which is about 3 magnitude fainter. The CROWDSAP parameters are 0.87358 and 0.92231 for Sectors 19 and 59, respectively. The optical companion may be a δ Scuti star.

HD 277132 = TIC 121064859: It appears to be an optical double. It is most likely an ellipsoidal, less likely a rotational variable with a β Cep pulsating component.

HD 300978 = TIC 458604640: It has a long period variable (4 magnitude dimmer) 114.02 arc seconds away from it. However, our analysis suggests that the signals come from the target.

HD 308106 = TIC 465870314: Blends with an optical double component 1.8 mag fainter, 0.6", and another star 1.7 mag fainter, 34". It cannot be excluded that one or both of these two stars contributed to the observed light variations.

HD 327010 = TIC 382486122: No significant contamination in the photometric aperture. The star is classified as an ellipsoidal variable with a possible β Cep component although we cannot completely rule out a rotational origin for the 7-d period.

HD 39716 = TIC 66975228: The star has no nearby contaminator. It is a possible ellipsoidal variable with hybrid β Cep/SPB pulsations.

HD 55687 = TIC 178374964: There is a 1.1 mag brighter cool star (HD 55688) and two fainter hot stars all within 77" of the target. Whereas the ellipsoidal variations should come from the target, these close-by objects could contribute to the short-period variations.

NGC 6913 82 = TIC 14621767: It belongs to an open cluster NGC 6913 (Wang & Hu 2000). It is not clear whether the long-period variation we detected is due to ellipsoidal variability or rotation.

A.4. *Rejected objects*

η Ori = TIC 4254645: It is a multiple system comprising of a detached eclipsing binary with an orbital period of 7.99 d and one component showing g-mode pulsations and a non eclipsing binary with a period of 0.864 d and strong ellipsoidal variations (Mason et al. 2001; Southworth & Bowman 2022a). No β Cep pulsation was detected.

BD+61 675 = TIC 84342607: The eclipses that are present in the S19 30-min data can be attributed to the nearby eclipsing binary SZ Cam (P=2.7 d). These eclipses are almost absent in the S59 2-min data, but β Cephei pulsations are still there with the same amplitude. We conclude that BD+61 675 is a non-eclipsing β Cephei star.

CD−59 4169 = TIC 383089500: The eclipses observed in this objects' *TESS* light curve come from target, but the pulsations from the nearby TIC 383089586.

CPD−59 3141 = TIC 467066902: The eclipses are from a nearby source and the pulsation is too weak to be localized. Both the pulsational and eclipse signals are visible in Sector 64, a likely pointer to an external origin.

CW Cep = TIC 434893323 was first discovered to be eclipsing by Alfonso-Garzón et al. (2012) and as a β Cep pulsator by Lee & Hong (2021). These authors obtained an orbital period of 2.72914 d and two dominant pulsation frequencies of 2.7265 and 5.3405 c/d, which are close to be harmonically related, in agreement with what we also obtained from the QLP data. As both component are located in the β Cephei domain, it is not clear which of the components is (or whether both are) pulsating. However, the pulsation constants $Q = P\sqrt{(\rho/rho_{\odot}}$, with the stellar mean density derived from the parameters listed by Lee & Hong (2021) for those two frequencies are 0.102/0.052 or 0.110/0.056 d, respectively. We therefore conclude that the pulsations in this system are due to gravity modes. Hence, this star is disqualified as a β Cep pulsator.

FZ CMa = TIC 125497512: FZ CMa was first discovered to be a double-lined spectroscopic binary by Neubauer (1943), eclipsing by Moffat & Vogt (1974) and β Cep by Southworth & Bowman (2022a). Detailed photometric and spectroscopic analyses of the system has been presented in literature (e.g. Moffat et al. 1983; Southworth & Bowman 2022a). The pulsation spectrum is dominated by a 2.7 c/d signal and possible harmonics and subharmonics. The masses that Southworth & Bowman derive for this system are around 5 times solar. All this is evidence that FZ CMa is an SPB rather than a β Cep star.

HD 153772 = 212415990: It was classified as β Cep pulsator by Pigulski & Pojmański (2008). However, it is located in a very crowded field with nearby sources of relatively similar magnitude. It has very shallow eclipses as well. The light curve shape of the single short-period variation (3.276 c/d) resembles an ellipsoidal variation rather than a pulsation.

HD 154646 = TIC 380870688: The eclipses of the target are quite shallow and arise from the nearby Gaia source 5963347209003877888. The pulsation, however, appears to emanate from HD 154646.

HD 217919 = TIC 434723918: It was discovered to be a spectroscopic binary by Garmany (1972) and eclipsing β Cep pulsator by Southworth & Bowman (2022a). We obtained an orbital period of 16.2080(9) d which is in agreement with the period obtained by Southworth & Bowman (2022a) but in disagreement with that obtained by Garmany (1972). Southworth & Bowman (2022a) report significant third light and say the pulsations could arise in the third, non-eclipsing component. Again, the pulsation spectrum looks like a harmonic series of g mode pulsations. We suspect that this system is a rapidly oscillating representative of the SPB stars.

HD 308111 = TIC 465869053: The light curve causing the longer period variations appears to be of rotational instead of ellipsoidal origin.

LS II +23 34 = TIC 360661624: Eclipses come from target, Porb = 10.9815 d. Pulsations come from nearby LS II +23 36.

LS CMa = TIC 63427664: It was classified as a poor β Cep candidate in eclipsing binary by Southworth & Bowman (2022a). As the single observed frequency not of orbital origin is below the β Cep regime, we reject this object from our candidate list.

V Pup = TIC 269562415: It was identified by Budding et al. (2021) as a massive close binary system of Algol-type evolution and a secondary that had experienced a mass ejection instead of a mass transfer. Contrary to these authors, we do not find any coherent periodic variability apart from the eclipses. There seem to be instrumental effects and/or stochastic light variations present in the light curves of this bright object, but no β Cephei pulsations.

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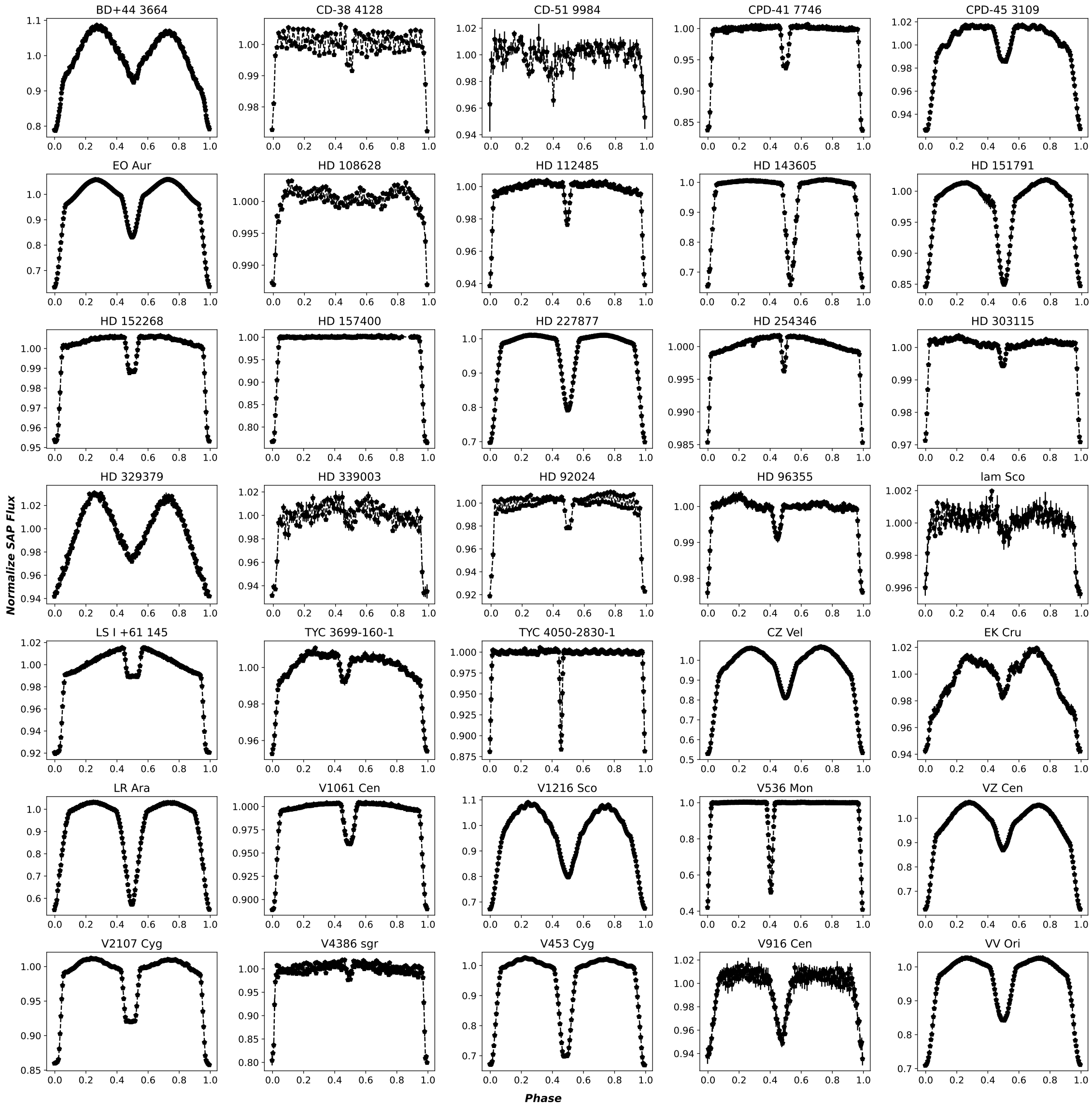

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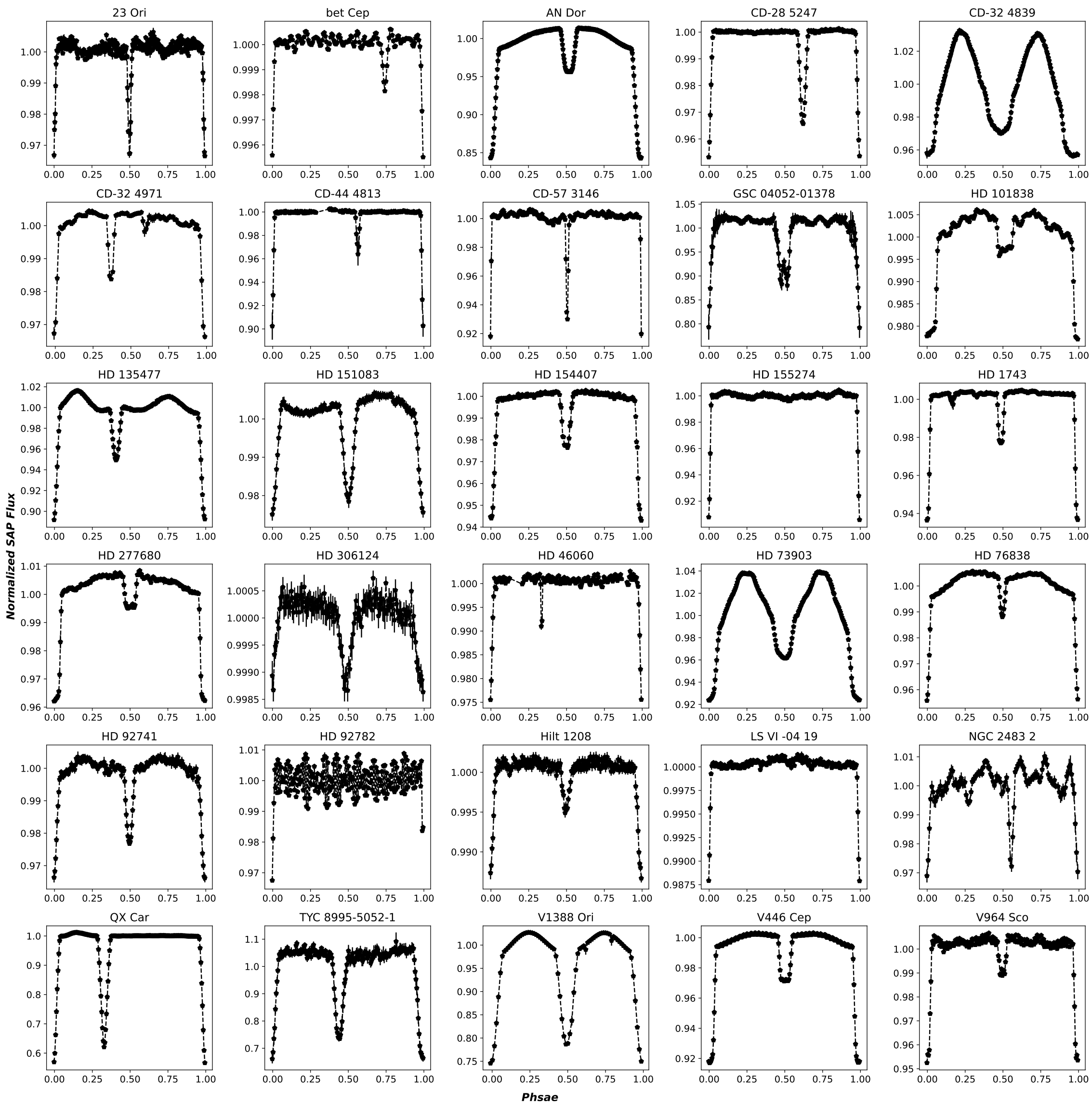

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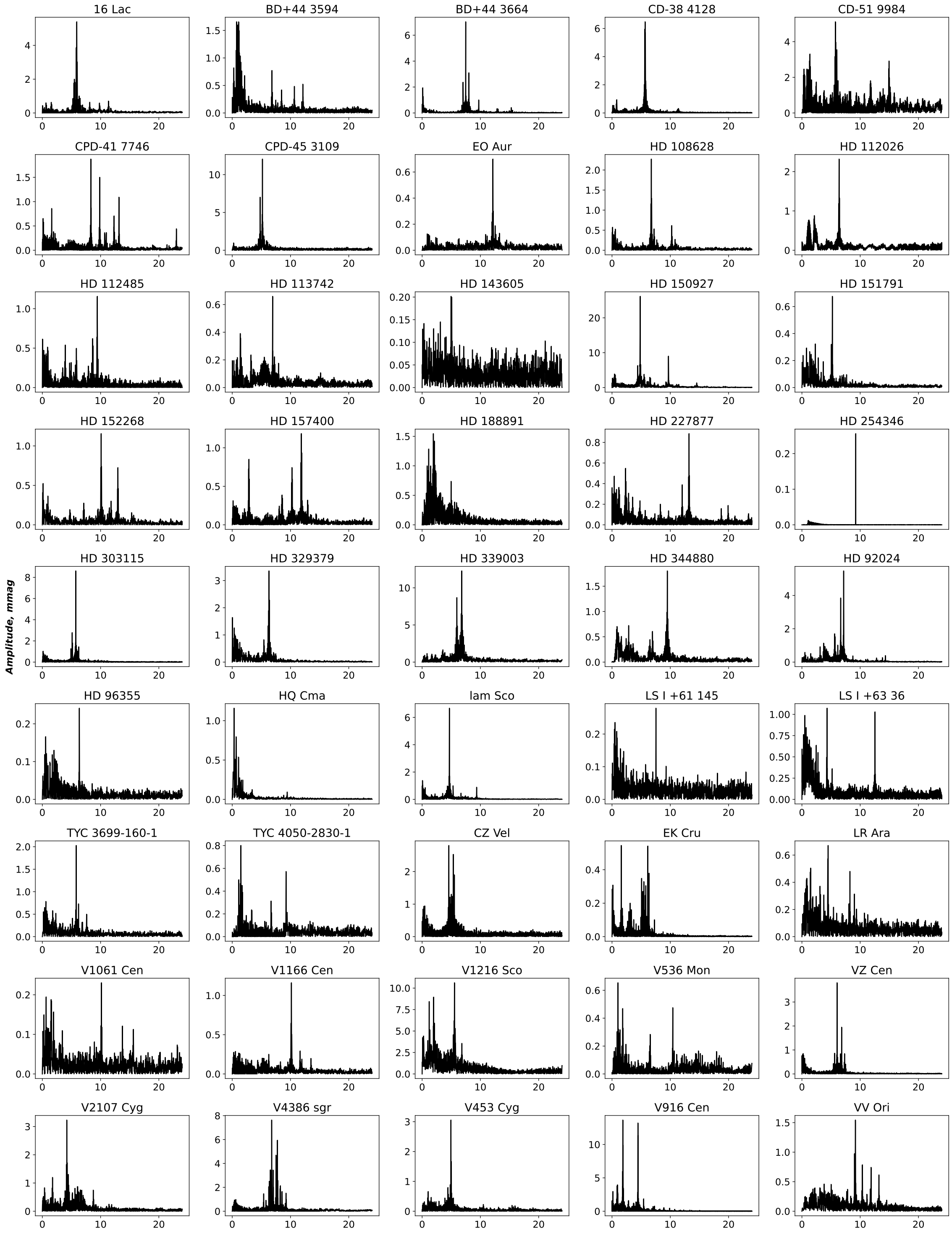

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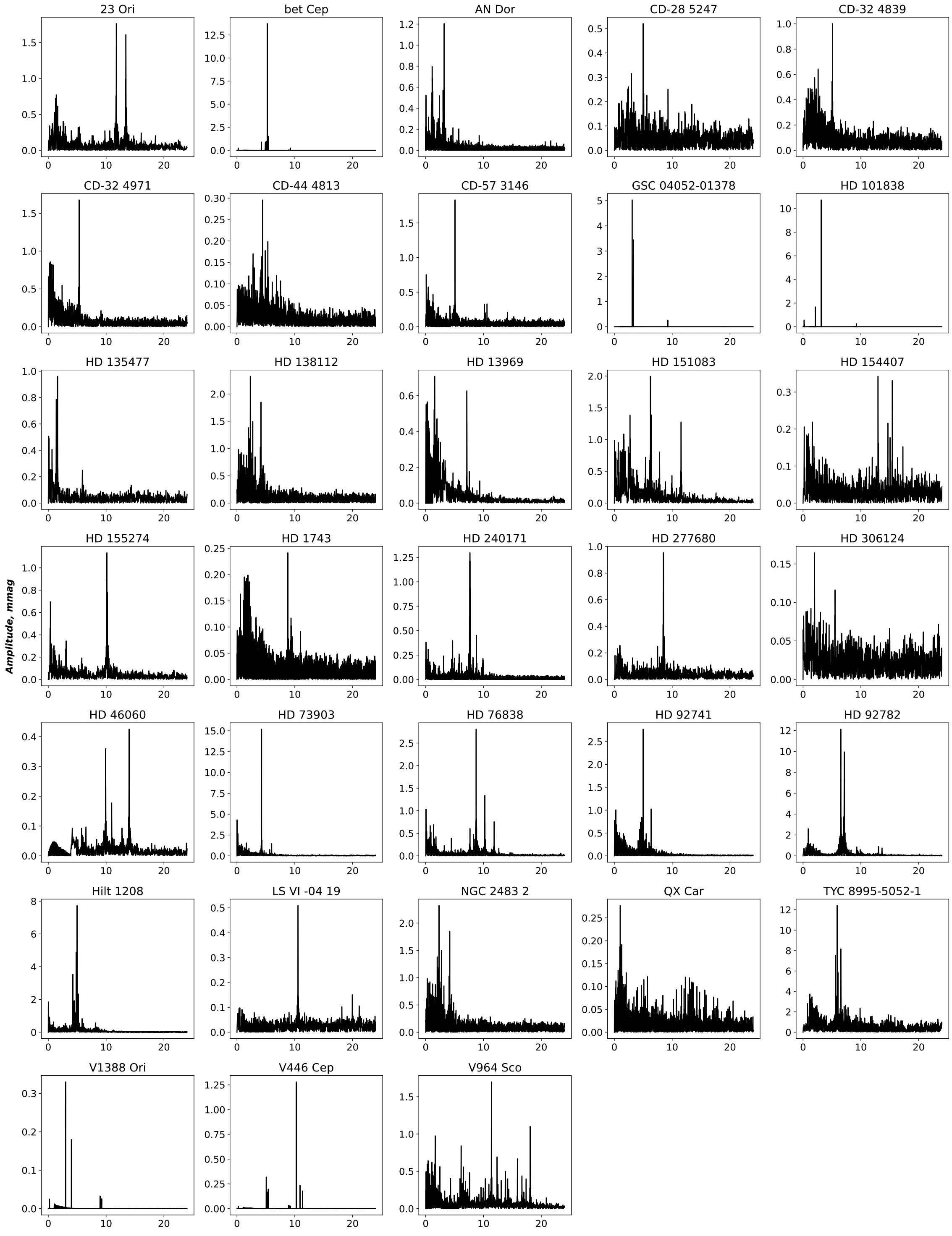

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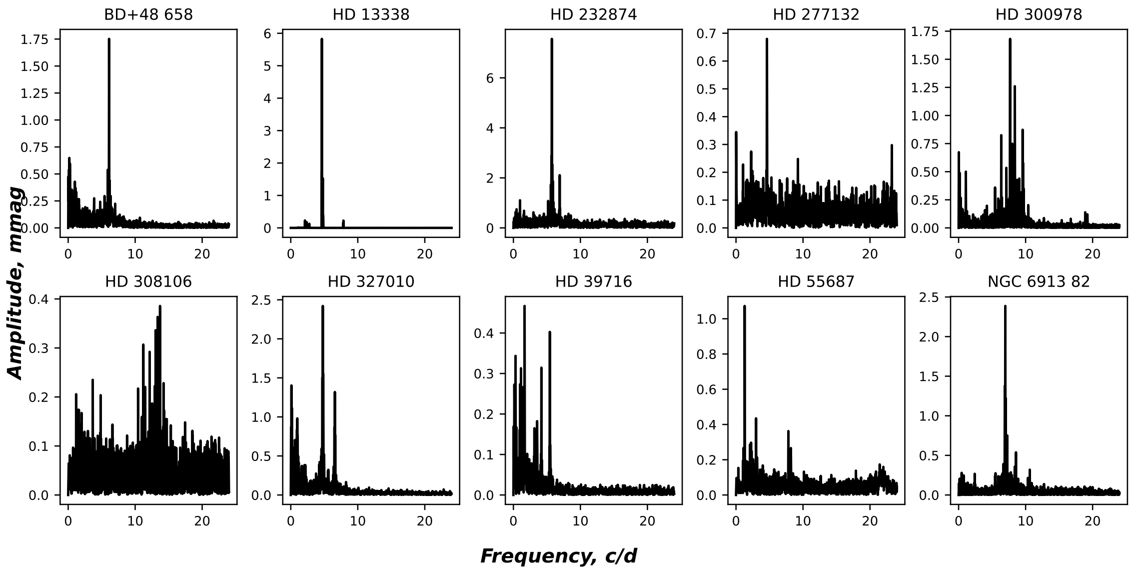

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