Pre-*TESS* observations of pulsating white dwarf stars at Konkoly Observatory

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Introduction

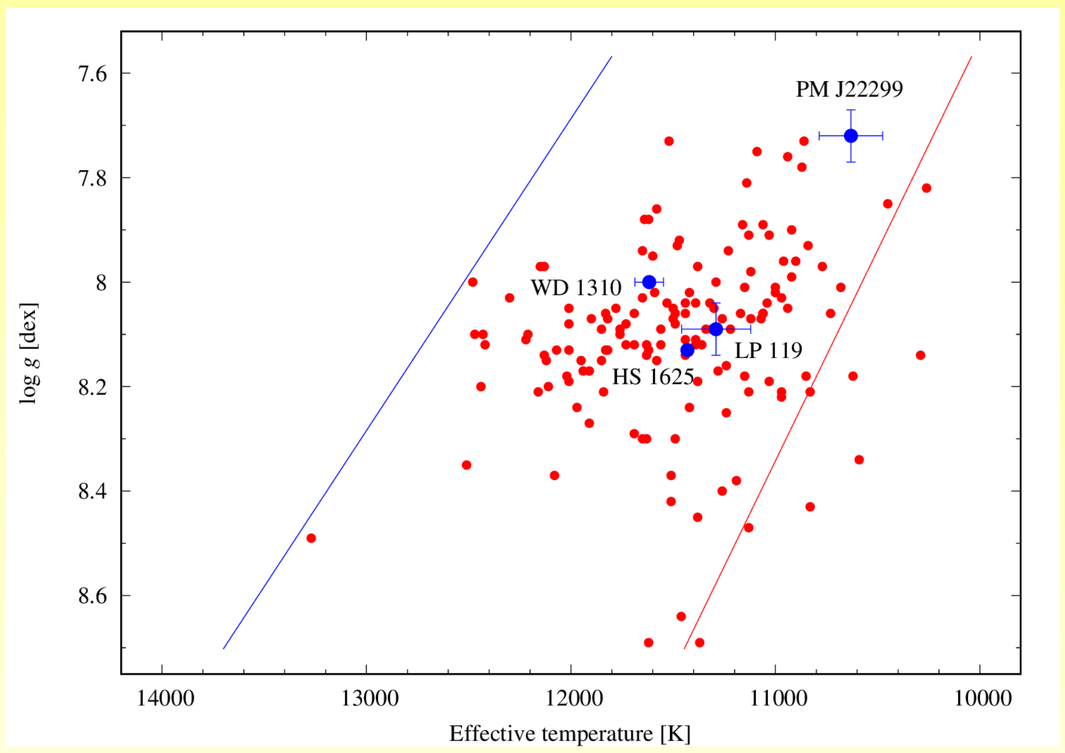
The *TESS* (Transiting Exoplanet Survey Satellite) all-sky survey space mission provides a unique opportunity to study the short-period pulsations of white dwarf variables with the currenctly available 120-second cadence mode. We performed survey observations at the Piszkéstető mountain station of Konkoly Observatory, Hungary, to find new bright white dwarf pulsators that are potentially interesting targets for *TESS*. **We successfully identified two new pulsators, WD 1310+583 and PM J22299+3024**, a variable candidate (EGGR 120), and derived detection limits for possible pulsations for 18 objects. We also performed extended observations of two other proposed *TESS* targets, **LP 119-10** and **HS 1625+1231**, respectively. With the practically one-season long measumerents of WD 1310+583, PM J22299+3024, LP 119-10, and HS 1625+1231, we determined a set of eigenmodes for all targets for astreroseismic investigations. With the *TESS* observations, we expect to be able to revise these lists of eigenmodes. We present here the results of our measurements on these four variables.

WD 1310+583

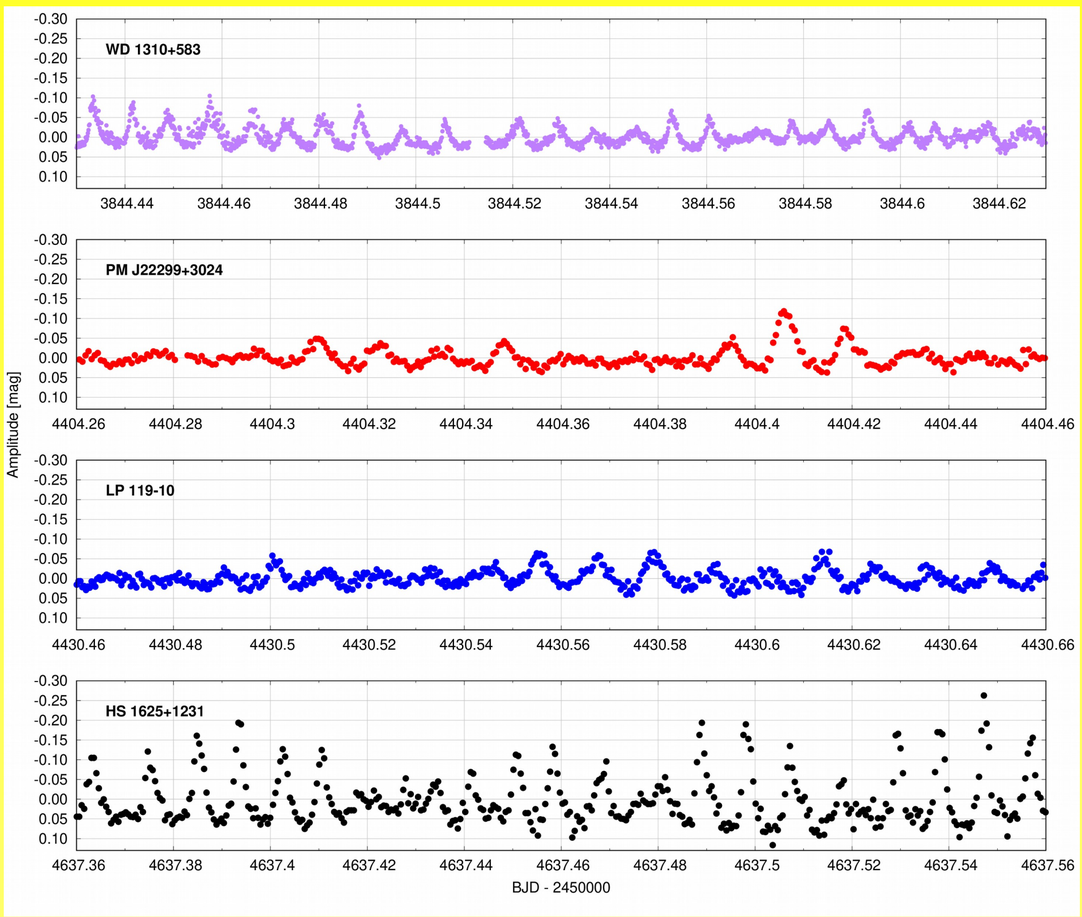
WD 1310+583 (*B* = 13.9 mag) was observed on eight nights during the 2017 March–July term, and we determined 17 significant frequencies by the whole data set (Bognár et al. 2018, MNRAS, 478, 2676). Seven of them seem to be independent pulsation modes with 365.0, 510.6, 571.0, 694.5, 940.6, 1038.4, and 1577.3 sec periods. The additional, closely spaced frequencies to this modes suggest the presence of amplitude and/or phase variations, frequently observed in ZZ Ceti stars in the middle of the instability strip or close to its red edge. This newly discovered relatively bright WD variable is an excellent target for small telescopes.

HS 1625+1231

HS 1625+1231 (*B* = 16.1) was reported as a new ZZ Ceti variable by Voss et al. (2006, A&A, 450, 1061). They detected three pulsation periods at 385.2, 533.6, and 862.9 sec. We observed this star on 14 nights in the 2019 observing season (March–July), and our frequency analysis resulted in the determination of six pulsation modes at 513.7, 697.0, 741.5, 834.6, 847.7, and 880.9 sec.



The four ZZ Ceti stars on the instability strip. Effective temperature and surface gravity values are from table 4 in Bognár & Sódor (2016, IBVS, 6184) (red dots), from Limoges et al. (2015, ApJS, 219, 19) for PM J22299 and LP 119, from Kepler et al. (2015, MNRAS, 446, 4078) for HS 1625, and from the paper of Gentile Fusillo et al. (2018, MNRAS, 473, 3693) in the case of WD 1310. Blue and red lines denote the hot and cool boundaries of the instability strip, according to Tremblay et al. (2015, ApJ, 809, 148).



Light curve segments of the four ZZ Ceti stars presented here.

PM J22299+3024

We discovered the variability of **PM J22299+3024** (*g* = 15.9 mag) in July 2018. At that time we referred to it as a variable candidate, as only one night of observations was available on this target (Bognár et al. 2019, AcA, 69, 55). However, the subsequent observations proved that PM J22299+3024 is indeed a new, bright ZZ Ceti star, laying close to the red edge of the instability strip. Based on 14 nights of observations (2018 July–November), we accepted eight modes, which can be inputs for asteroseismic fittings at 967.4, 994.6, 1041.1, 1084.7, 1130.0, 1172.9, 1261.0, and 1334.6 sec. However, its complex frequency structure suggests that further modes may be present in the data set. The *TESS* observations will hopefully clear this situation up.

LP 119-10

LP 119-10 (*B* = 15.3) was discovered to be a variable star by Green et al. (2015, ASPC, 493, 237). They presented one frequency at 873.6 sec in the discovery publication. We collected data on this star altogether on 20 nights between October 2018 and April 2019. Our data analysis revealed an even more complex frequecy structure than in the case of PM J22299+3024, and we could determine ten pulsation modes at 767.5, 772.0, 820.4, 832.3, 847.7, 864.7, 900.2, 941.4, 978.4, and 1005.0 sec.

Future plans

We plan to analyse the *TESS* observations on these targets, correct the periods if needed, complete the list of known eigenmodes with the ones detected by the space-based measurement (if any), and perform asteroseismic fits utilizing the modes derived this way. All four stars are amongst the targets proposed for *TESS* observations. The planned data collection times for the different targets are as follows:

– WD 1310+583: Sector 15, from 2019. 08. 15., Sector 22, from 2020. 02. 18.,

– PM J22299+3024: Sector 16, from 2019. 09. 11.,

– LP 119-10: Sector 19, from 2019. 11. 27.,

– HS 1625+1231: Sector 25, from 2020. 05. 13.

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