Comm. in Asteroseismology
Vol. 150, 2007

Doubling the number of DBVs and a closer look at their Instability Strip

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Abstract

Prior to the Sloan Digital Sky Survey (SDSS), there were only nine known DBVs compared to 35 DAVs. The latest SDSS DR4 White Dwarf Catalogue (Eisenstein et al. 2006) has quadrupled the number of known white dwarf stars. We have been searching for new DBVs from the SDSS catalogue. Increased numbers of DBVs will help us better understand the structure and evolution of DBs, the nature of their instability strip as well as plasmon neutrino processes (Winget et al. 2004). We searched for DBV candidates using effective temperatures and surface gravities determined by fitting SDSS spectra with Koester's atmosphere models. We then obtained time-series photometric data on those with fit temperatures near those of the known pulsators. So far we have discovered 8 new DBVs, nearly doubling the number of previously known DBVs. With increased numbers of DBVs, we will be able to better characterize the instability strip, but, we also need more precise determinations of the temperatures and surface gravities via better signal to noise spectra and better lower limits for the observed non-variables. This effort is ongoing.

Acknowledgments. Funding for the SDSS and SDSS-II has been provided by the Alfred P. Sloan Foundation, the Participating Institutions, the National Science Foundation, the U.S. Department of Energy, the National Aeronautics and Space Administration, the Japanese Monbukagakusho, the Max Planck Society, and the Higher Education Funding Council for England. The SDSS Web Site is `http://www.sdss.org/`.

References

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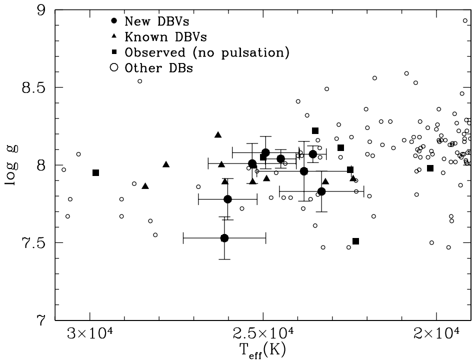

Figure 1: Effective temperatures and surface gravities of the SDSS DBs (Eisenstein et al. 2006) around the DBV instability strip, along with the previously known DBVs with their physical parameters taken from Beauchamp et al. (1999). Solid dots show the new DBVs and triangles the previously-known DBVs. Squares show the DBs which did not show any variability and hollow circles show the rest of the DBs in the SDSS DR4 WD catalogue. Most of the DBs which we did not see any variability so far have such high amplitude limits that we cannot tell if they are truly non-pulsators or not. To characterize the instability strip better, we need better determinations of the physical parameters (from better signal-to-noise spectra) and better variability amplitude limits (1 mma or better). We found no pulsator hotter than EC20058 and hence the best chance of determining the neutrino production rates still lies with this star.

Table 1: Results of our work so far. The top section of the table shows the objects that showed variability during at least one observation. Separated by a double vertical line, the second half of the table shows the objects which did not yet show variability. In the status section, we noted the objects which showed variability by "DBV". For the objects we have not seen variability of, we put the amplitude limit in the status section. The objects we have only observed once are noted by (1). Beating of multiple modes and amplitude modulation can make a pulsator appear as a non-pulsator. Therefore, we aim to observe each object at least two separate times, including new pulsators to ensure we have found a real pulsator.

Object (SDSS J)	g[mag]	T_{eff}	σ_{Teff}	$logg$	σ_{logg}	Status
034153.03-054905.8	18.113	24490	440	8.04	0.060	DBV
094749.40+015501.8	20.034	23819	1362	7.96	0.192	DBV(1)
140814.63+003838.9	18.981	25314	1271	8.01	0.129	DBV(1)
125759.03-021313.3	19.050	26114	1191	7.53	0.137	DBV
104318.45+415412.5	19.041	26020	846	7.78	0.133	DBV
122314.25+435009.1	18.838	23312	1218	7.83	0.131	DBV(1)
130516.51+405640.8	17.389	23562	386	8.07	0.054	DBV
130742.43+622956.8	18.710	24926	962	8.08	0.104	DBV(1)
001529.74+010521.3	18.711	35974	899	8.00	0.129	7.2(1)
085950.29-000339.6	20.022	25289	2588	8.00	0.289	11.8(1)
090409.03+012740.9	17.850	22480	521	7.97	0.060	3.5
090456.11+525029.8	18.665	36708	615	7.94	0.087	9.0(1)
092200.97+000834.3	18.450	22754	729	8.11	0.070	6.8(1)
095256.68+015407.6	17.292	32600	295	8.15	0.038	4.3(1)
095649.55+010812.4	20.361	17143	915	7.32	0.240	11.5(1)
101131.88+050729.3	18.841	24767	937	7.79	0.106	8.1(1)
101502.95+464835.3	18.433	23355	552	8.05	0.068	6.2(1)
105929.60+554039.2	18.458	24877	553	8.10	0.099	7.6(1)
122241.27-003614.4	17.947	23497	624	8.22	0.061	4.1(1)
133215.93+640656.2	18.285	20176	751	7.98	0.076	8.7(1)
135610.32-002230.6	19.230	17033	265	8.00	0.155	11.1(1)
141258.17+045602.2	17.191	29822	318	7.95	0.040	2.6
231324.24-001636.9	19.632	22331	3809	7.51	0.309	16.9(1)
235322.16+002653.8	19.594	25000	1649	8.05	0.186	11.2(1)