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A Model Survey of DAV White Dwarfs

S. J. Kleinman, S. D. Kawaler, A. Bischoff

Iowa State University, Dept. of Physics and Astronomy, Ames, IA 50011, USA

Abstract. We have created a grid of DAV (ZZ Ceti) pulsation models to test whether ensemble observations of DAV pulsation periods can be used to determine the nature of the DAV interiors.

Clemens (1993, 1994) combined the observed periods from all known hot DAVs (HDAVs: those with relatively low amplitudes, higher temperatures, and pulsation periods less than 600 s) and found they formed groups with an average period spacing near 50 s. This and other logic combined to suggest that the HDAVs are quite similar in their overall structure and compositions. The masses of their overlying H and He layers had to be quite similar, although he found a correlation of a slightly decreasing H layers with increasing overall mass. Kleinman (1995) and Kleinman et al. (1998) applied a similar approach to the cooler DAVs (CDAVs: those with relatively higher amplitudes, cooler temperatures, dominant pulsation periods of 600 s or larger, and which are less stable from season to season than the HDAVs) and reached similar conclusions.

DAs with similar H layers present some unique problems for other areas of white dwarf research (the spectral evolution explanation of the DB gap, for example), so we decided to test the validity of the Clemens/Kleinman approach through numerical models. We now have a grid of DA pulsation models with 19 masses from 0.5 to 0.9 $M_{\odot}$, 10 temperatures between 10 500 and 13 000 K, 14 H layers from 10^{-4} to 10^{-12} $M_{\odot}$, and 5 He layers from 10^{-2} to 10^{-6} $M_{\odot}$. This totals to 13 300 models with $\ell = 1$ and $\ell = 2$ periods calculated from 100 to 1000 s.

Our approach is to simulate distributions of DAV parameters (mass, T, $M_{\rm H}$, and $M_{\rm He}$) and extract ensemble periods from models randomly chosen from these distributions. We ask the question: *Can we distinguish between different DAV distributions solely by looking at the ensemble pulsation periods?* Our preliminary results is a qualified *yes*. We have found our H and He grids are too sparse and are working on expanding them to get more reliable results. Details will certainly be published elsewhere as soon as we finish our analysis.

References

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