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# Nonradial Pulsations of the DA Type White Dwarf Star G 255-2

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**Abstract.** Photometric data obtained on the DA type white dwarf star G255-2 between 1991 and 1997 were reduced and the pulsation spectrum was explored with the standard process. The further analysis provides 10 normal, probably $\ell$=1, independent nonradial eigenmodes.

## 1. Introduction

The pulsations of variable white dwarfs provide probes for measuring their internal structure and composition. The DA type white dwarf stars, as the coolest and oldest of the four known classes of pre-white dwarf and white dwarf pulsators, are the most critical in constraining the ages of the stellar population in our galaxy (both the disk and the halo populations).

The DA type white dwarf star G255-2, a very northern object ($\delta \sim 80°$), was discovered to be pulsating by Vauclair et al. (1981), with two main periods at 830 s and 685 s of amplitude about 0.04 mag. Between 1991 and 1997, G255-2 was observed for four seasons. The reduction of the data and the analysis of the pulsation spectrum give more information about the pulsations of this star.

## 2. Observations

In February 1991 and December 1993 respectively, G255-2 was observed at the Observatoire de Haute-Provence (OHP, France) with the 1.93m telescope for 2 nights. In November 1995 and February 1997, two bi-site observation campaigns were organised with the 1.93m telescope at OHP and the 2.16m telescope at the Xinglong station of Beijing Astronomical Observatory (China). All the observations were made with identical Chevreton 3-channel high-speed photoelectric photometers. The data reduction was performed with the standard procedure, providing 117 hours of normalized light curves.



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## 3. Power spectra and mode identification

The power spectrum was calculated for each light curve using the multiple-frequency analysis program MFA (Hao 1991). As the pulsations are amplitude variable, the significant frequencies found for the four data sets were added together to get a cumulative power spectrum. After rejecting possible remaining aliases and linear combinations, we were left with 10 possible eigenmodes as listed in Table 1. Their average period spacing is 56 s. The mode at $f_2$ shows a triplet structure with almost symmetrical components at $\pm$ 19 $\mu$Hz, a rather unusually large frequency shift if due to rotational splitting. It suggests that this mode is an $\ell$=1 mode. The period distribution seems to fit consecutive $k$ orders (with the possible exception of the mode $f_6$) with some modes missing. According to Brassard et al. (1992), this period spacing corresponds to the period spacing expected for theoretical $\ell$=1 modes, if the mass of G255-2 is about 0.6$M_\odot$ and the effective temperature is 12300 K (Bergeron et al. 1995).

Table 1. The eigenmodes of G255-2.

| Flag | Frequency (mHz) | Period (s) | ΔP (s) | Flag | Frequency (mHz) | Period (s) | ΔP (s) |
|---|---|---|---|---|---|---|---|
| $f_1$ | 1.103601 | 906 | - | $f_6$ | 1.516238 | 660 | 21 |
| $f_2$ | 1.169628 | 855 | 51 | $f_7$ | 1.645316 | 608 | 52 |
| $f_3$ | 1.234166 | 810 | 45 | $f_8$ | 1.746830 | 573 | 35 |
| $f_4$ | 1.308227 | 764 | 46 | $f_9$ | 2.167233 | 461 | 112 |
| $f_5$ | 1.468677 | 681 | 83 | $f_{10}$ | 2.503857 | 399 | 62 |

## 4. Conclusions

G255-2 is the second DAV after G 29-38 (Kleinman et al., 1998) which has been observed in multiple seasons. Its cumulative power spectrum reveals 10 significant eigenmodes interpreted as $\ell$=1 modes. As a DAV, G255-2 shows modes stable in frequency (but variable in amplitude) which reappear in precise places in the power spectra in different years. Work is in progress to derive more constraints on the model of G255-2.

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