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A two-site study of QW Puppis

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Abstract.
A multi-site campaign involving photometry and high resolution spectroscopy from South Africa and New Zealand of the gamma Doradus star QW Puppis has been completed. This is the first spectroscopic analysis of QW Puppis. Preliminary results are given below.

Key words. Stars: oscillations – Stars: individual (QW Puppis)

1. Introduction

Gamma Doradus variables are found just beyond the cool edge of the Delta Scuti instability strip and display high order low-degree non-radial photospheric g-mode pulsation with typical periods between 8 and 80 hours.

This campaign involved the gamma Doradus variable QW Puppis. We obtained spectroscopic and photometric observations at the South African Astronomical Observatory (SAAO, longitude +21) and at Mount John University Observatory (MJUO, longitude +170) to reduce the effect of daily aliases.

QW Puppis is a F0 IV variable with four photometrically determined frequencies: 1.0434 cd^{-1}, 0.9951 cd^{-1}, 1.1088 cd^{-1}, and 0.9019 cd^{-1}. The amplitude for the 1.0434 cd^{-1} frequency is ∼10 mmag with the other frequencies having amplitudes less than 5 mmag (Poretti et al. 1997).

2. Photometry

SAAO V band photometry of QW Puppis was obtained on five nights during 23 March-3 April 2005. Periodograms of the photometry result in strong one day aliases as the MJUO data has yet to be included in the detailed analysis.

The QW Puppis photometry periodogram has peaks at 6.08, 1.10 and 1.05 cd^{-1} (we assume that the 2.10 cd^{-1} is an alias of the 1.10 cd^{-1}) all with approximately the same strength. The 6.08 cd^{-1} frequency may also be an alias of the 1.10 cd^{-1} blend. The 0.91 cd^{-1} frequency is present but is weaker than frequencies at 9.3 cd^{-1} and 0.64 cd^{-1}.

3. Spectroscopy

At SAAO and MJUO, 146 QW Puppis spectra were taken during the period 22 March-4 April 2005. The spectra have average signal-to-noise ratios of ∼180. Stacked plots of the Ca I 610.2 nm line for QW Puppis (Fig. 1) show temporal line profile progressions.

4. Spectroscopic frequency analysis

The first moment Lomb-Scargle periodogram of QW Puppis (Fig. 2: top) shows a strong triple peak at 1.02 cd^{-1} and others at 0.93, 1.14 and 0.33 cd^{-1}. The blended peaks at 1.02 cd^{-1}

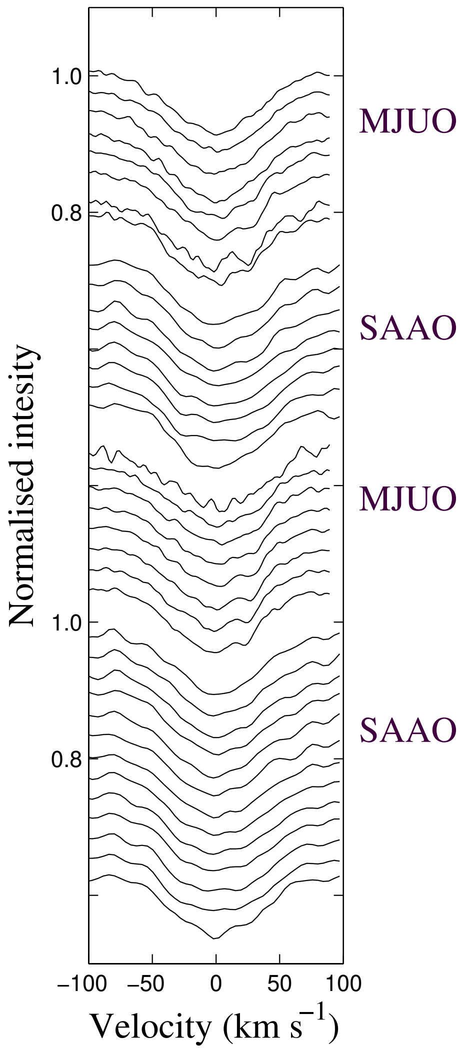

Fig. 1. Stacked spectra of QW Puppis. Time increases upward on the y-axis. There is a ~0.2 day gap between the groups of spectra obtained at SAAO and MJUO.

and the 0.93 cd^{-1} frequencies agree with the previously identified frequencies of Poretti et al. (1997). The second moment periodogram (Fig. 2: bottom) is very similar to the first presenting the same frequencies except the one at 0.33 cd^{-1}. These frequencies also agree with

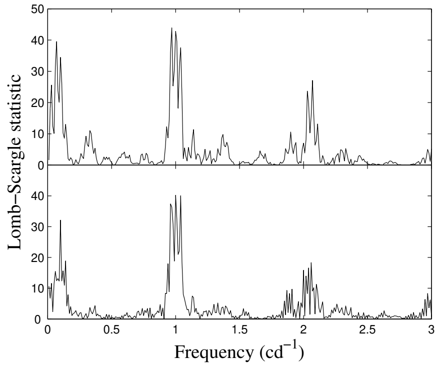

Fig. 2. Top: First moment of the Ca I 610.2 nm line for QW Puppis. Bottom: Second moment of the Ca I 610.2 nm line for QW Puppis.

some of the photometric frequencies obtained. The discrepancy may be due to the poor sampling of the photometric observations.

5. Discussion

m The moments of the line profiles have shown frequencies that agree with the previous photometry of Poretti et al. (1997). The second moment's periodogram shows similar frequencies to those of the first moment. The variations observed in the spectra are small bumps progressing across the profile. This indicates a higher order oscillation as expected for a gamma Doradus star. The moment analysis method is not sensitive enough to identify this type of variation. Other methods being investigated to allow identification of the modes of oscillation are line profile fitting and line profile inversions (Berdyugina et al. 2003).

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References

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