

A PHOTOMETRIC AND SPECTROSCOPIC STUDY OF R CORONAE BOREALIS STARS IN THE LMC

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ABSTRACT. Over the last several years we have obtained photometric observations of the four suspected (W Men, HV 5637, HV 12671, HV 12842) R Coronae Borealis (RCB) stars in the Large Magellanic Cloud (LMC). Fourier analyses of the light curves has revealed some periodicity in HV 12842, where there appear to be at least two closely spaced periods of 55 and 60 d. High resolution spectra of HV 12842, obtained with the Anglo-Australian Telescope (AAT), indicate that it has similar atmospheric properties to a number of warmer galactic RCB and hydrogen-deficient Carbon (HdC) stars, e.g. R CrB, RY Sgr and XX Cam.

1. Discussion

Four RCB stars (see above) were identified in the LMC by Payne-Gaposchkin (1971). Feast (1972) obtained low resolution spectra of three of these stars and, from the C_2 band strength, concluded that W Men and HV 12842 resembled R Cr B and RY Sgr (weak C_2), whereas HV 5637 resembled S Aps (strong C_2). HV 12671 is a symbiotic star (Allen 1980) and hence its classification as an RCB star may be suspect.

While declines have been recorded for W Men, HV 5637 and HV 12842, there had been no attempt to observe these stars photometrically over a long timescale to search for periodicities, before the observations obtained at Mount John University Observatory (MJUO). These observations were obtained with the 1-m and two 0.6-m reflectors and automated single-channel photometers.

We have been monitoring W Men and HV 12842 since 1986 as part of a much larger survey of the characteristics of RCB and HdC stars (Lawson *et al.* 1990). We have ~ 110 and ~150 observations for these two stars respectively. Our data for HV 12842 are shown in Figure 1a and they include a decline near JD 2447970. (CCD observations of this decline are being obtained.) In Figure 1b, we shown an amplitude spectrum for those data obtained before the decline onset, which was calculated using the Lomb-Scargle Fourier method for non-equally spaced data (Scargle 1982). The two peaks which correspond to periods of 55 and 60 d (labelled in Figure 1b) may be responsible for the possible beating of the light curve which is apparent between JD 2446800-2447500. The inclusion of latter data weakens the significance of these peaks but the periods are not altered. We made some observations of HV 5637 (18) and HV 12671 (12) but these were discontinued due to the faint V mags of these stars (14.8 and 15.7 respectively).

High resolution spectra ($\Delta\lambda \sim 0.3 \text{ \AA}$) were obtained of HV 12842 and HV 5637 with the AAT and Australian National University échelle during 1988. In Figures 2a and 2b, we compare

spectra of HV 12842, R CrB and XX Cam (which is an HdC star) in the intervals $\lambda\lambda 6435 - 6470$ and $6655 - 6700 \text{ \AA}$. Key spectral features are indicated. The C I lines are of similar strength in all three stars, indicating that carbon continuous opacities are dominant (see Cottrell and Lambert 1982). In agreement with other abundance studies, many of the other metal lines are weaker in HV 12842, with the notable exception of the O I lines (assuming that its similar colours infer that this star has a similar T_{eff} to R CrB and XX Cam of 7000 K). The spectra of HV 12842 are currently being analysed to determine its atmospheric parameters and abundances.

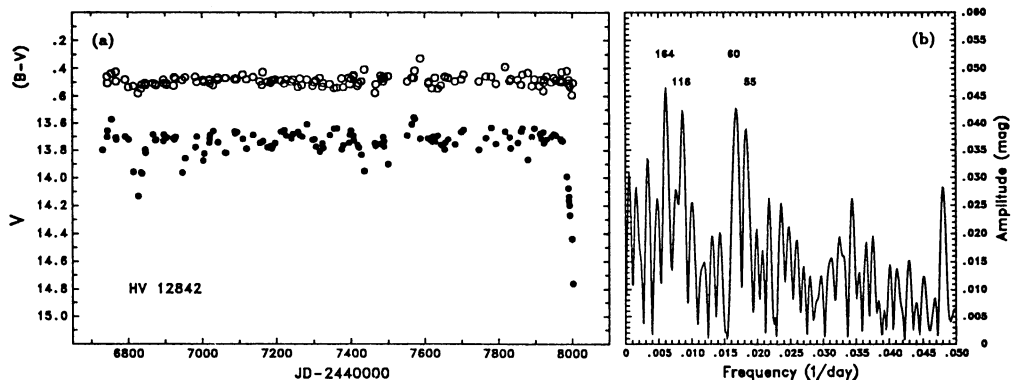


Figure 1. (a) V light and (B-V) colour curves for HV 12842.

(b) Amplitude spectra for data obtained prior to JD 2447870. The period (in days) of several peaks are labelled.

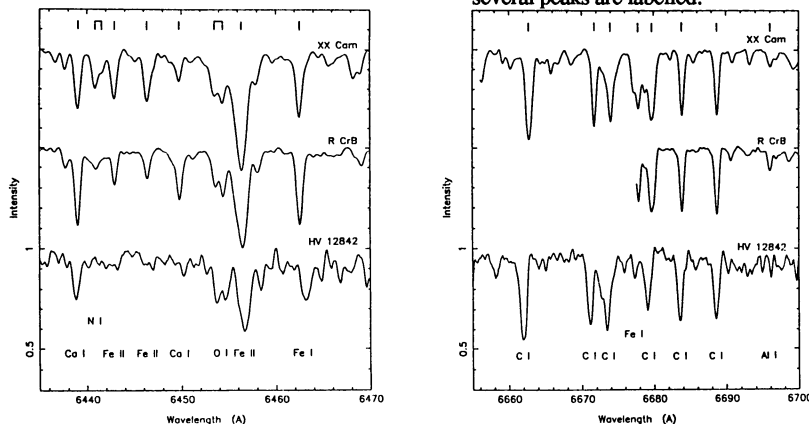


Figure 2 (a) and (b) Comparative spectra of HV 12842, R CrB and XX Cam.

2. References

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