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Long-term Photometric Monitoring of Cool Hydrogen-deficient Carbon Stars

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1. Introduction and observations

Interest in the hydrogen-deficient carbon (HdC) stars, and the R Coronae Borealis (RCB) stars in particular, has been rekindled by the realisation that these stars provide the potential for testing models in a number of areas. These include: pulsation theory; grain formation; grain evolution; stellar nucleosynthesis and extended stellar atmospheres.

Observational work on these objects has increased dramatically over the last 10 years. This has included both spectroscopic and photometric projects, see Lambert & Rao (1994) and Lawson et al. (1990).

We have continued to observe a number of the cool HdC stars in the Galaxy and the LMC and now have light curves exceeding 2000 days in duration for many of these objects. In particular, we are observing the RCB stars to investigate both the low amplitude, pulsation-related variations present at maximum light and the photometric behaviour during the large amplitude declines.

With respect to the deep declines that the RCB stars undergo, we continue with the working definition of 'red' and 'blue' declines to broadly characterise this phase. This was introduced by Cottrell et al. (1990). This corresponds to the colour of the star as it initially begins to dim in light output and appears to be related to the geometry of the obscuring dust cloud. There is substantial variation in this characteristic and it is hoped that this data set will provide a significant starting point for a better definition and understanding of not only this phase, but also the rise out of these deep declines.

2. Comments on individual stars

Of the stars under investigation four (RY Sgr, V854 Cen, S Aps and the LMC RCB star HV 12842) have been chosen for detailed comment (see Figure 1).

RY Sgr has continued to provide distinct pulsations in both the V and colour curves and has had two distinct declines, one short, 'red' event and the other a deeper, longer and extremely 'blue' decline. The onset times of the declines are related to the 38-d pulsation period (Pugach 1977).

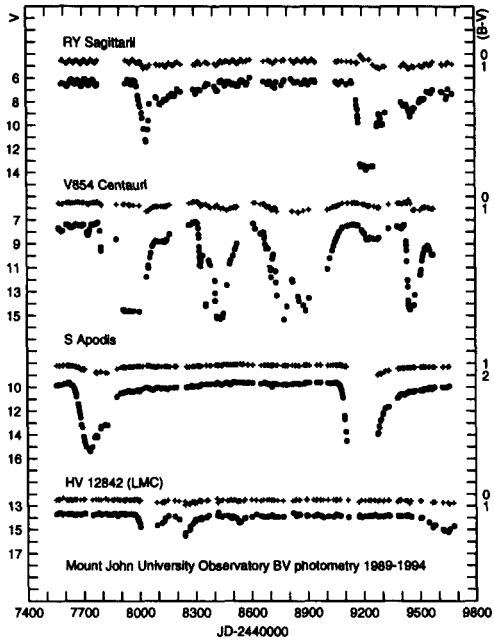

Figure 1. *V* and *(B–V) light curves for a selection of RCB stars.*

V854 Cen continues to be the most active RCB star, with declines in each of the last 5 years. There is great variety amongst the declines, with both 'red' declines and 'blue' declines. The times of onset of the declines are closely related to the 43-d pulsation period of the star (Lawson et al. 1992).

S Aps has undergone two deep declines during this period, with the one in 1989 an example of a 'red' decline, whereas the 1993 decline shows an almost constant colour for the first ten days of the decline. There are also some distinct pulsations during the rise out of these declines, which are not readily distinguishable at other phases.

HV 12842 has been the more active of the two LMC stars that we have observed. Its declines have been both short-lived and relatively shallow.

References

Cottrell, P.L., Lawson, W.A., & Buchhorn, M. 1990, MNRAS, 244, 149
Lambert, D.L., & Rao, N.K. 1994, J. Astr. Ap., 15, 47
Lawson, W.A., et al. 1990, MNRAS, 247, 91
Lawson, W.A., et al. 1992, MNRAS, 256, 339
Pugach, A.F. 1977, IBVS, 1277