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OBSERVATIONS OF THE ACTIVE SOUTHERN RS CVn BINARY V841 Cen IN 2007 AND 2008 – A LARGE, LONG–LIVED SPOT WAVE

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V841 Cen (HD 127535) is an active single–lined RS CVn binary of orbital period just under 6 d (Collier Cameron, 1987). The star is one of the more active southern RS CVn systems having been detected at microwave frequencies, both in short–term flare events and more slowly varying 'quiescent' emission (Slee et al., 1987a, 1987b). Photometric data have been presented by a number of workers – Udalski & Geyer (1984); Innis et al. (1985); Bopp et al. (1986); Collier Cameron (1987); Mekkaden & Geyer (1988); Strassmeier et al. (1994); and especially Cutispoto (1990, 1993, 1996, 1998a, & 1998b). These data show a ∼6 d spot wave of varying amplitude, usually ∼0.05 to ∼0.25 mag in V, with smaller associated colour changes. The spot wave is highly variable (op cit.), changing at times within a few weeks (e.g. Innis et al., 1998).

We observed V841 Cen at the Brightwater Observatory in 2007 and 2008. A description of the observatory and techniques is given in Innis et al. (2007). In brief, a short–focus, 70–mm telescope and cooled CCD is used to obtain a field of view near $0\overset{\circ}{.}8 \times 0\overset{\circ}{.}55$, allowing target and comparison stars to be observed simultaneously. The observations in B and V filters were transformed to the Cousins system. We used exposure times of 45 sec in B and 30 sec in V. We combine 4 such individual (and consecutive) exposures in each filter to form normal points. Usually 4 or more normal points in each of B and V were obtained on a given night.

We collected 38 nights of data between 2007 April–September (∼ 180 normal points in each filter), and a further 9 nights of data between 2008 April and May (∼ 130 normal points in each filter). We used HD 128227 as the comparison star and CPD -59° 5634 as the check star. For the normal points we find for these stars magnitude differences (and standard deviations) ΔV: 1.256±0.016 for 2007; 1.263±0.012 for 2008; ΔB: 0.985±0.028 for 2007; 0.998±0.042 for 2008. These results indicate no detectable variation in the comparison and check stars above observational scatter. For the comparison star HD 128277 we use V =8.33 and $B - V$ =1.07 (which are average values from the work of Bopp et al., 1986; Collier Cameron 1987; Mekkaden & Geyer, 1988; and Cutispoto, 1990,1993,1996, 1998a, 1998b – all those authors report V and $B - V$ values that closely agree).

Figure 1 shows the data for V841 Cen plotted against HJD. The top panel shows V data, the lower panel shows $B - V$. The dots represent the 2007 April–September data, and the crosses represent the 2008 April–May data. The range in V is very large, slightly over 0.4 mag.

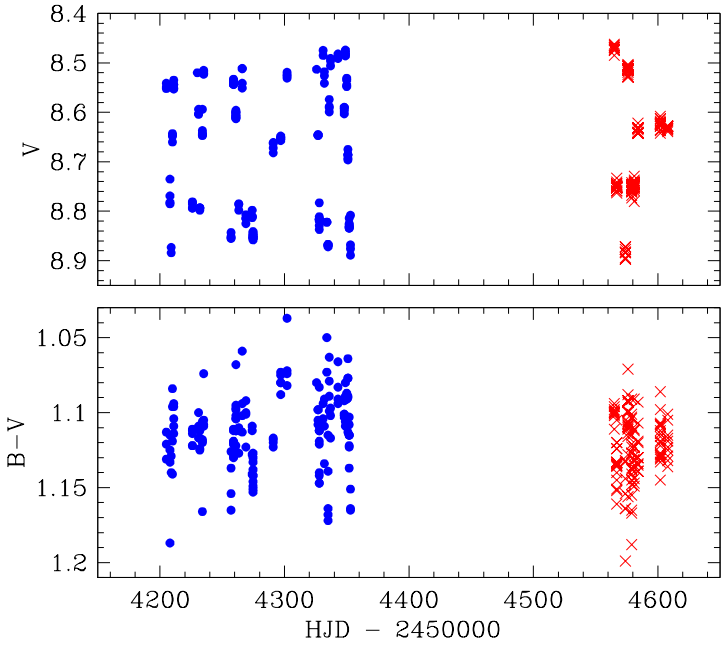

Figure 1. Brightwater Observatory V data (top) and $B-V$ (lower) data for V841 Cen. The dots represent the 2007 April–September data, and the crosses represent the 2008 April–May data.

We use the period of 5.988 d and epoch HJD 2444653.737 (Innis et al., 1998) for the phase plots shown in Figure 2. These observations show that, given the rapid changes the star has exhibited previously, the light curve has been remarkably stable over the ∼13 month extent of the dataset. The lower panel of Figure 2 shows $B-V$ versus V. A clear colour change of several hundredths of a magnitude is seen. The star appears to have been slightly redder in 2008 compared to 2007.

In Figure 3 we have collected the known V photometric range versus year for V841 Cen, obtained from the references listed above. The most recent data show that both maximum and minimum light are comparable to the historical extremes. What is unusual is that the 2007 and 2008 data show such a large range of ∼0.4 mag in V, which is significantly larger than has been seen previously for this star. It is also among the largest spot waves seen for this class of object. That the spot wave has apparently maintained this amplitude over 13 months is of further interest.

Assuming a spot or spot group that contributes effectively no flux compared to the unspotted photosphere, at minimum light approximately 45% of the visible stellar disk must be covered to produce the ∼0.4 mag spot wave. The data indicate that such a large spot or spot region remained relatively unchanged during the observing interval. An alternative hypothesis would be that the large amplitude is a consequence of a bright spot on one hemisphere, and a dark spot on the other. This would however require two spots (or spot regions) to stay relatively stable over a year. If so, by reference to the overall V variation in Figure 3, one may also need to conclude such a bright spot had been present previously to account for maximum light in the 1994 observations. The data do not allow us to determine if this was the case, but postulating a single long–lived spot or spot group requires fewer assumptions.

We intend to continue monitoring V841 Cen. We expect that, given the history of this star, the large amplitude spot wave is likely to exhibit significant changes in the near future.

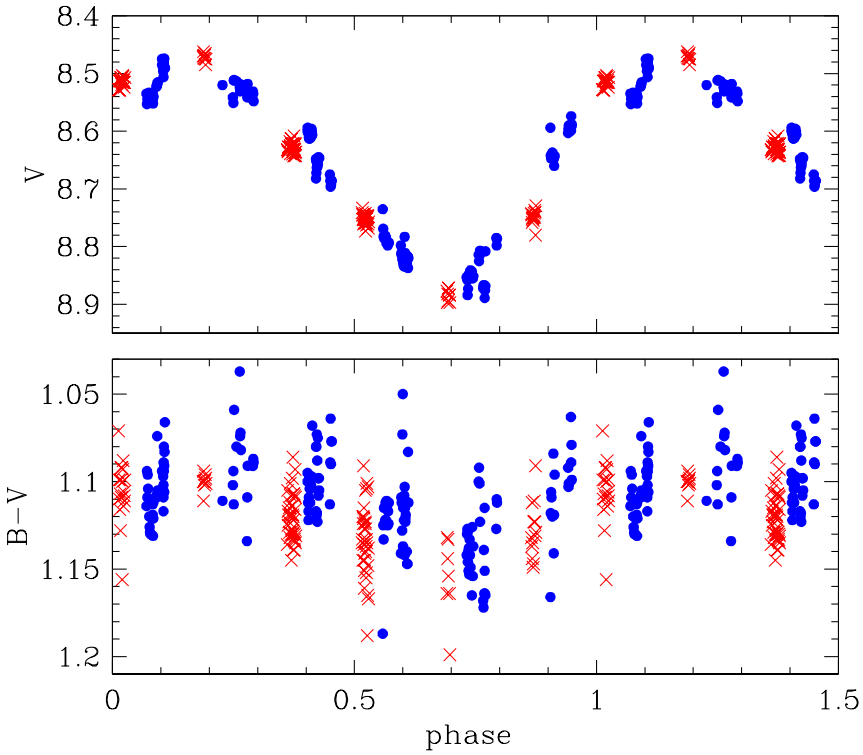

Figure 2. Top panel: V light curve for V841 Cen using the period of 5.988 d and epoch HJD 2444653.737 (Innis et al., 1998). Lower Panel: $B-V$ colour index curve of V841 Cen. In both panels the dots represent the 2007 April–September data, and the crosses represent the 2008 April–May data.

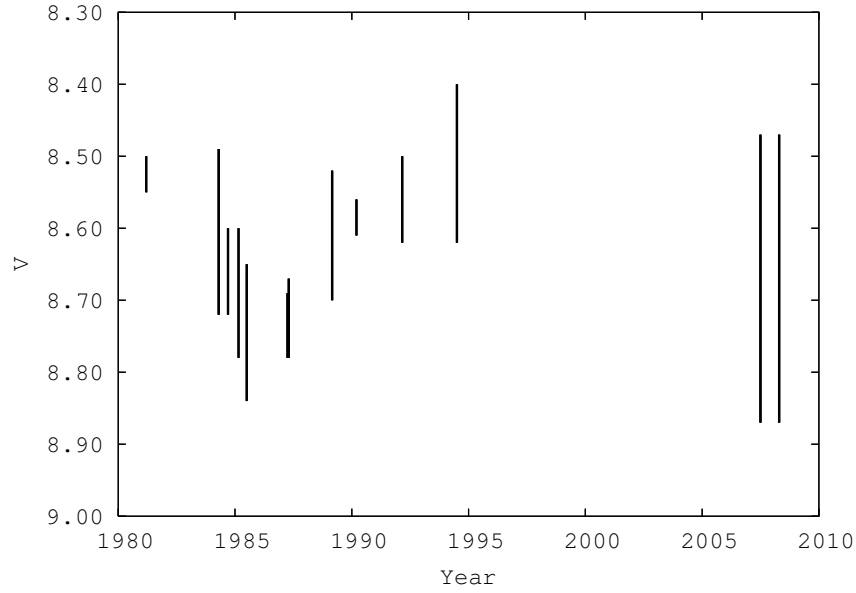

Figure 3. Range in V light for V841 Cen.

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References:

Bopp, B.W., Africano, J., & Quigley, R., 1986, *AJ*, **92**, 1409
Collier Cameron, A., 1987, *SAAO Circ.*, **11**, 57
Cutispoto, G., 1990, *A&AS*, **84**, 397
Cutispoto, G., 1993, *A&AS*, **102**, 655
Cutispoto, G., 1996, *A&AS*, **119**, 281
Cutispoto, G., 1998a, *A&AS*, **127**, 207
Cutispoto, G., 1998b, *A&AS*, **131**, 321
Innis, J.L., Thompson, K., & Coates, D.W., 1998, *IBVS*, 4570
Innis, J.L., Coates, D.W., Thompson, K., Nelson, G.J., Slee, O.B., Wright, A.E., 1985, *PASA*, **6**, 160
Innis, J.L., Coates, D.W., & Kaye, T.G., 2007, *Per. Zvezdy*, **27**, 1
Mekkaden, M.V., & Geyer, E.H., 1988, *A&A*, **195**, 214
Slee, O.B., Nelson, G.J., Stewart, R.T., Wright, A.E., Jauncey, D.L., Vaughan, A.E., Large, M.I., Bunton, J.D., Peters, W.L., & Ryan, S.G., 1987a, *PASA*, **7**, 55
Slee, O.B., Nelson, G.J., Stewart, R.T., Wright, A.E., Innis, J.L., Ryan, S.G., Vaughan, A.E., 1987b, *MNRAS*, **229**, 659
Strassmeier, K.G., Paunzen, E., & North, P., 1994, *IBVS*, 4066
Udalski, A., & Geyer, E.H., 1984, *IBVS*, 2594

ERRATUM FOR IBVS 5838

In IBVS 5838, first page, third paragraph, the comparison star of V841 Cen is mentioned with two different HD numbers. The correct name of the star is HD 128227.

The Editors