TWENTY YEARS OF DEDICATED PHOTOMETRY OF RS CVn AT CATANIA OBSERVATORY

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We present a complete set of yearly seasonal light curves (LC) of RS CVn obtained from 1963 to 1982 at Catania Observatory, integrated with two LCs obtained by Ludington (1978) in 1975 and 1976. This unique observation set vividly shows (Figure 1) the migrating outside of eclipse "photometric wave" (PW), which was first evidenced by Catalano and Rodonò (1967) and it is now considered the distinctive photometric feature of RS CVn binaries as well as of other spotted stars. By attributing the PW to surface inhomogeneities, or spots, whose visibility is modulated by the spotted star rotation, the present PW migration toward decreasing orbital phases indicates that the angular rotation of the KOIV spotted component is slightly lower than the orbital one. An inspection of Figure 1 readly shows that the almost sinusoidal PW has been fairly stable from 1963 up to 1981, when a double-peaked wave, still present in the 1982 LC, developed. Most probably the "unusual" 1949 LC by Keller and Limber (1951) and the 1976 one by Ludington (1978) were obtained at a similar activity phase.

As apparent from the two upper panels in Figure 2, the migration rate of the PW has been ever increasing: from 0.06 (1963) to 0.29 (1981) orbital periods/year. Also evidence of a past migration reversal has been recently given by the present authors (Blanco et al 1982). In the same paper we have shown that the observed migration behaviour of the PW - advancing, receding and increasing rate - is qualitatively consistent with a solar-type spot-cycle drifting toward the equator in a differentially rotating star.

The highest observed value of the PW migration rate ($0^P.29$/year) gives a lower limit of 7.4×10^{-3} for the differential rotation ($\Delta\Omega/\Omega$) between the average latitudes of spots with the lowest and the highest angular velocity. On the other hand, the fairly constant median magnitude of RS CVn outside-of-eclipses does require a remarkably stable

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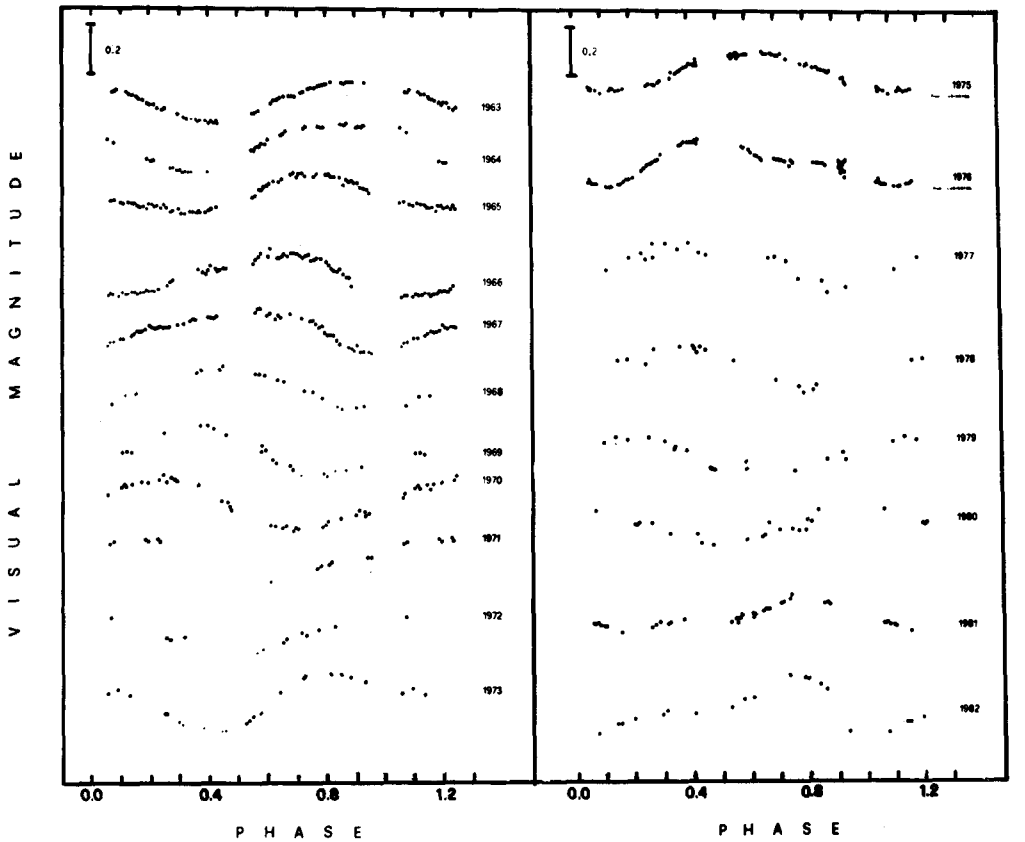

Figure 1. Outside-of-eclipse V light curves of RS CVn obtained at Catania Observatory from 1963 to 1982. The 1975 and 1976 observations are from Ludington (1978).

average spot activity level from 1963 to 1982, though some indication of a 5-year spot cycle has been presented (Rodonò 1981, Reglero 1982).

Finally, the cyclic variation of the orbital period (lower panel in Fig. 2) seems to be connected with the possibly cyclic direct and reverse migration of the PW, i.e. some dynamical interaction between the orbital motion and the differential rotation of the KOIV star producing the migration of the active regions on its surface is likely to occur (see also Rodonò 1981 and Catalano 1982).

We have summarized the main results and questions raised by the systematic observations of RS CVn carried out at Catania Observatory. Twenty years of dedicated photometry have allowed us to establish the short-term behaviour of this interesting binary and to give some indication on its long-term behaviour. As expected, observations ever

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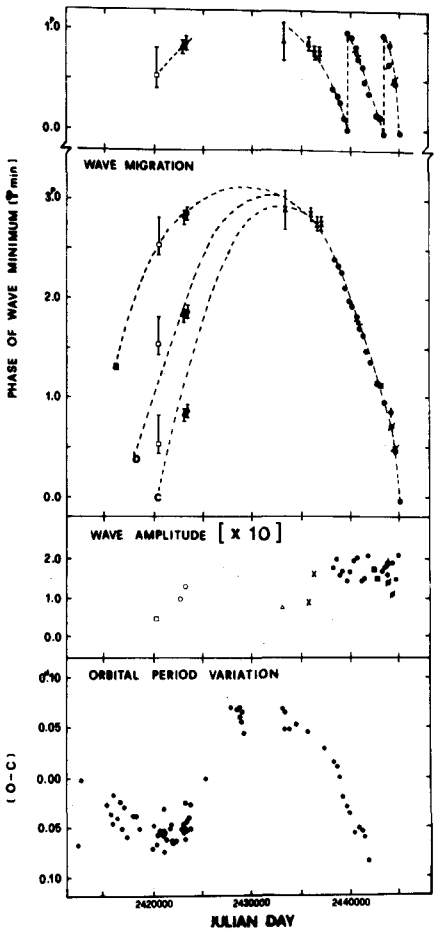

Figure 2. First panel (from top): orbital phase of the wave minimum on the light curves of RS CVn vs. Julian Date. Second panel: successive passages of the wave minimum on the light curve; three possibilities (a,b,c) are indicated. Third panel: outside-of-eclipse wave amplitude vs. JD. Fourth panel: cyclic variation of the orbital period about the mean value 4.797855 from Catalano and Rodonò (1974). The different symbols indicate different sources.

rise questions related to their interpretation and our present ones cannot be an exception. However, we are now beginning to grasp some clues on the RS CVn phenomenon and we hope that several RS CVn systems will be observationally "adopted" by other observers. Actually, only systematic long-term programs will enable us to understand the true nature and physics of RS CVn binaries and of other spotted stars.

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