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PHOTOMETRIC OBSERVATIONS OF THE RS CVn BINARY σ Cr B

The bright component (HD 146361) of the visual binary σ Cr B (ADS 9979 AB) is a double - line spectroscopic binary with period of 1.14 day (Batten et al., 1978) which has all the characteristics of an RS CVn system. It shows intense chromospheric, transition region and coronal activity as seen in the optical, UV and X-ray bands (Young and Koniges 1977, Tarafdar and Agrawal 1984, Agrawal et al. 1980). Bopp (1984) has recently concluded that σ Cr B is the most chromospherically active main-sequence system once observed.

Based on their photometric observations Skillman and Hall (1978) concluded the presence of a wave-like distortion with an amplitude of 0^m05 (V) with a minimum at 0.4 phase. They also found evidence for a short-time variability similar to that of δ Scuti type stars superposed on the distortion wave. In order to verify this result we carried out photometric observations of this system with the 1.2 m telescope of Japal-Rangapur Observatory in the UBV bands during 1981 and 1982 using 20 arc second diaphragm.

We observed this system on 11 nights in UBV passbands and used HR 6043 and HR 6108 as comparison and check stars, respectively. The photometric equipment, method of observations and the reduction techniques employed for deriving Δm (variable minus comparison) have been described in a previous paper (Vivekananda Rao and Sarma, 1983). The r.m.s. error of Δm (check minus comparison) was found to be $\sim 0^m02$ in UBV passbands indicating that the comparison star is constant in brightness during the period of observations within these limits. The phases of observations are calculated using the following ephemeris given by Tanner (1949).

$$JD (Hel) = 2423869.105 + 1. d_{139789E}$$

Figure 1 shows the plot of Δm versus phase for the observations obtained in the UBV passbands. Unfortunately our observations do not cover the phase range 0.45 to 0.75. Due to this gap in the light curves, no firm conclusion regarding the presence of a wave-like distortion in this system can be made. However, from the remaining phase coverage (0.00 to 0.20, 0.30, 0.45 and 0.75 to 0.00) we conclude that within the limits of observational errors σ Cr B is nearly constant in brightness in each of the three passbands.

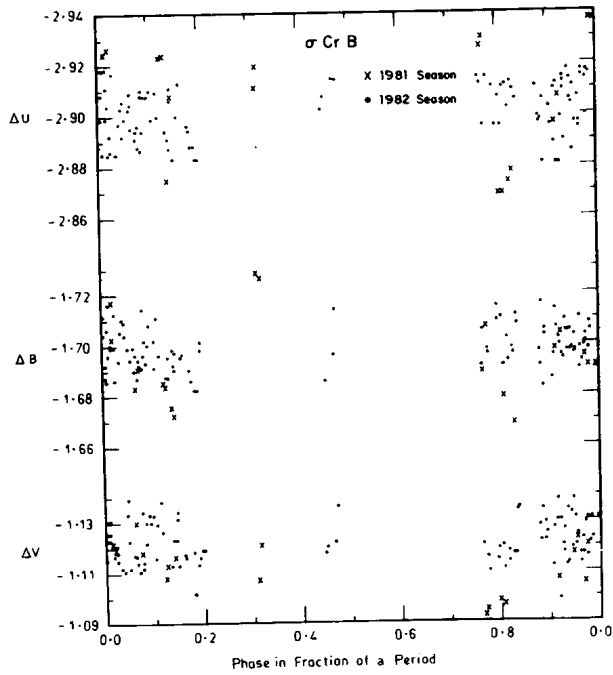


Figure 1: Observed values of Δm in UBV bands plotted as a function of binary phase using the ephemeris of Tanner (1949)

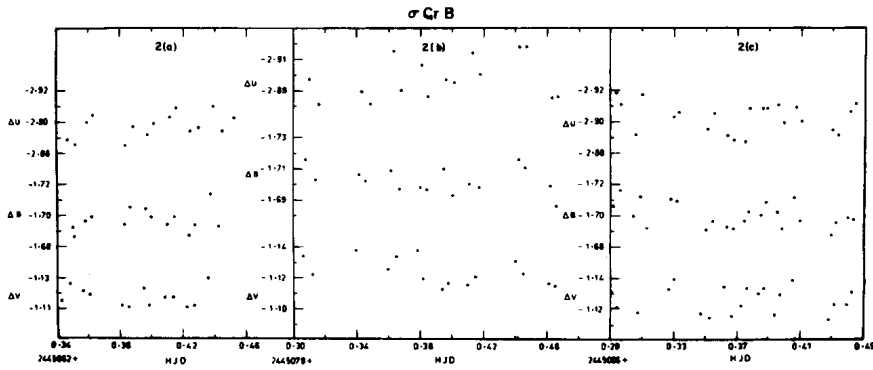


Figure 2: Photometric data in UBV bands for three of the nights.

To determine the nature and periodicity of the δ Scuti type variability if any, we have monitored this system on a few nights for more than 2.5 hrs. continuously. These observations are shown in Figure 2(a)- 2(c) for 3 of the nights. From these figures it is very clear that σ Cr B does not exhibit any δ Scuti type variability of period 0.1 day except for a small scatter which is comparable to the spread in the (check minus comparison) observations. Skillman and Hall (1978) suggested the possibility of the comparison star being the source of variations in σ Cr B. They could not confirm this in the absence of a check star. However, during the present observations, we used the same star for comparison (HR 6043) as was used by Skillman and Hall (1978) along with a suitable check star (HR 6108). From our (check minus comparison) star observations it was found that the comparison star used by us and Skillman and Hall (1978) was constant in brightness within the limits of observational errors ($\pm 0.02^m$). Hence, the suspicion of Skillman and Hall (1978) about the possible variable nature of the comparison star is not confirmed by our observations. We conclude by stating that there is no indication of any δ Scuti type variations in our observations of σ Cr B.

We, however, suggest that further photoelectric observations of σ Cr B with small diaphragms should be made to study the variable nature of HD 146361. Such observations obtained over long periods will be valuable in interpreting the distortion wave properties of HD 146 361 and its similarity to other members of the RS CVn group.

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P. VIVEKANANDA RAO, M.B.K. SARMA,	P.C. AGRAWAL, M.V.K. APPARAO
Centre of Advanced Study in Astro-	Tata Institute of Fundamental Research
nomy, Osmania University,	Colaba,
Hyderabad 500 007. India	Bombay 400 005. India

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