ULTRAVIOLET AND OPTICAL OBSERVATIONS OF THE MASS-LOSING CONTACT BINARY SV CENTAURI

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I INTRODUCTION

SV Cen is a well known early-type contact binary. The less massive component is a slightly evolved B1 star. The secondary is of spectral type B4 III. The period of the system is P = 1.6585 days. SV Cen shows with $\dot{P}/P = -2\ 10^{-5}\ yr^{-1}$ one of the largest known period decreases. We carried out ground-based photoelectric and spectroscopic (coudé) observations at ESO, and high dispersion UV observations at VILSPA, with the aim

a) to derive new orbital parameters of SV Cen

b) to determine further epochs of minima (i.e. to study the period variations)

c) to look for possible mass loss indicators in the ultraviolet range.

II ORBITAL ELEMENTS

From 23 coudé spectrograms (dispersion 20 Å/mm) taken during 1977 - 1979 at ESO-La Silla, a more precise mass ratio of $M_2/M_1 = 1.25$ was derived. A photoelectric light curve was observed with the two-channel photometer of the ESO 50cm telescope. The comparison of the measurements with synthetic light curves which were calculated with the computer code of Wilson and Devinney (1971) yields the orbital elements and system parameters given in Table 1. The maximum preceding the secondary minimum is systematically brighter than the theoretical symmetric light curve by a few hundreds of a magnitude, conceivably due to mechanical heating of the transferred matter.

C. Chiosi and R. Stalio (eds.), Effects of Mass Loss on Stellar Evolution, 487–489.

Table 1: System Parameters of SV Cen

Period	$P = 1^{d}.6585$	Temperatures	$T_1 = 23\ 000$ K $T_2 = 14\ 000$ K
Inclination	$i = 82^{o}$	Abs. Mag.	$M_V(1) = -3^{M}.4$ $M_V(2) = -2^{M}.5$
Radii	$R_1 = 6.8\ R_{\odot}$ $R_2 = 7.3\ R_{\odot}$		
Masses	$M_1 = 7.7\ M_{\odot}$ $M_2 = 9.6\ M_{\odot}$	Filling Factor	$\frac{\Omega_{ic} - \Omega}{\Omega_{ic} - \Omega_{oc}} = 0.92$

III MASS LOSS FROM SV CEN

No indicators for mass loss have been found so far in the visual region. For this reason, Wilson and Starr (1976) have interpreted the period decrease of SV Cen by conservative mass transfer from the more massive component to the less massive one. Such a mass exchange, however, occurs on a very short (thermal) time scale, and it is unlikely to observe a system during this short-lived phase.

Recent high dispersion IUE observations (Nov. 3, 1979) at orbital phase 0.44 (cf. Drechsel et al., 1980a) have revealed the occurrence of mass ejection from the system; the displacement (with terminal velocities ranging from 800 to 2000 km/s) of strong resonance absorption lines (C II, C IV, Si IV, Al III, Mg II, etc.) clearly exceeds the escape velocity from the binary system.

IV CONCLUSIONS

In agreement with earlier investigations (Irwin and Landolt, 1972; Rucinski, 1976; Wilson and Starr, 1976), the new system parameters derived from our recent and more extensive observations prove SV Cen as a close (contact) binary system. Our IUE spectra have shown that SV Cen is losing mass, hence it is definitely not a conservative system.

Contrary to earlier suggestions, we would like to explain the period decrease by mass loss. We suggest that the mass-losing star is the less massive component. Due to the combined effects of Coriolis forces and kinetic overshoot energy, a dynamical flow pattern as indicated in Fig. 1 could be expected. Matter is transferred from the less massive star through the inner Lagrangean point L_1, and is released through L_3. The mass loss rate required to explain the observed period decrease of

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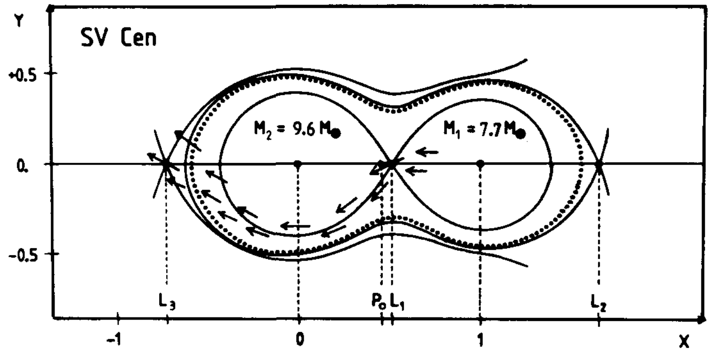

Figure 1: Roche equipotentials (solid lines) in the equatorial plane of SV Cen. The dotted line represents the common envelope of the contact binary.

$\dot{P}/P = -2\ 10^{-5} yr^{-1}$ is calculated to be of the order of $\dot{M} = 5\ 10^{-5}\ M_\odot\ yr^{-1}$ (Drechsel et al., 1980a).

A comparison of the observed line profiles with theoretical profiles given in the atlas of Castor and Lamers (1979) makes it plausible that even such a high mass loss rate could be consistent with the observations. Line profile calculations for UV resonance lines are being carried out in order to prove whether the observed mass loss rate can explain the period decrease by means of loss of angular momentum through the outer Lagrangean point L_3 (Drechsel et al., 1980b). Phase-dependent IUE observations are planned in order to obtain more detailed informations about the mass flow pattern within and around SV Centauri.

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