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## PERIOD OF SV CENTAURI CONTINUES DECREASING [1]

The eclipsing binary SV Centauri is an early-type (B2 V) contact system, which is known for its rapid period decrease - the fastest one among all binaries in terms of $\dot{P}/P$, averaging $-1.52 \cdot 10^{-5}$ $yr^{-1}$ during the last 100 years. The period has shortened from about $1.^d6606$ in 1894 to $1.^d6581$ in 1993. It has been shown that the rate of period decrease is not strictly constant and can exhibit fast changes, but has a long-term mean value of about 2.2 seconds per year. The period decrease and its irregularities can be ascribed to the mass exchange and mass loss of this rapidly evolving interacting system (Herczeg and Drechsel, 1985; hereafter HD).

New photoelectric UBV observations were carried out in January and February 1993 with the ESO 50cm telescope equipped with its standard single channel photometer. HD 102503 served as comparison star. Two primary minima could be covered in UBV colors. The following minimum times given as heliocentric Julian dates were derived by applying the Kwee-van Woerden (1956) and various other methods:

| | |
|---|---|
| Prim. min. I: | hel. J.D. $2449017.^d7636$ ($\pm 0.^d0007$) and |
| Prim. min. II: | hel. J.D. $2449022.^d7389$ ($\pm 0.^d0005$). |

As an example, Fig. 1 shows the data for primary minimum II in B color.

The two new minima were used for an O-C analysis to improve the previous ephemeris as given by HD, who had investigated all available photographic and photoelectric minimum timings of SV Cen between J.D. 2412608 and 2445669 (1894 to 1983). Due to the short-term variations of the rate of period decrease,

[1] Based on observations collected at the European Southern Observatory, La Silla, Chile

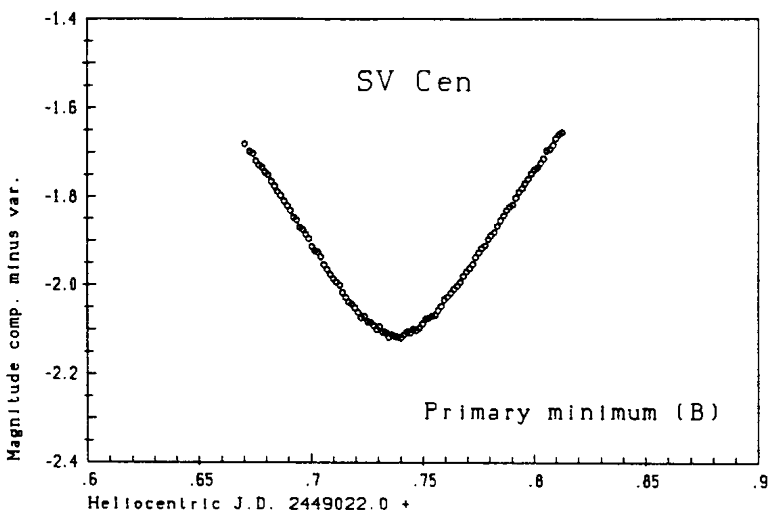


Fig. 1: SV Cen primary minimum of hel. JD 2449022.7389 in B. Integration time was 1 second; points shown are 30 second means.

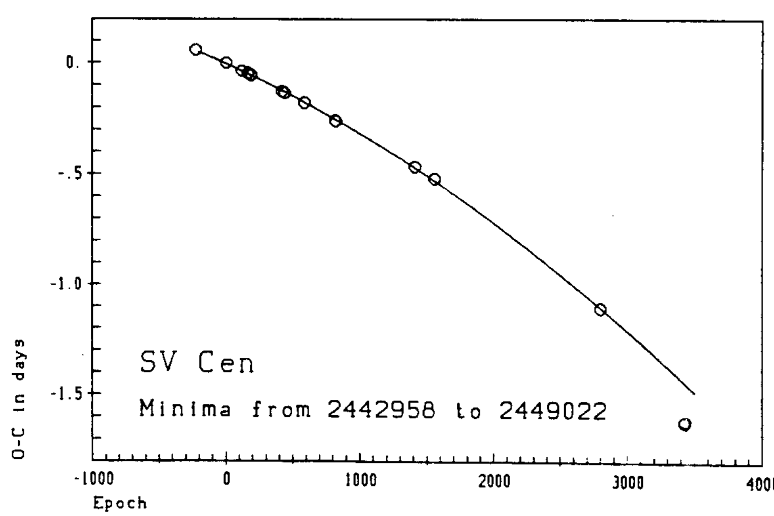


Fig. 2: O-C fit of minima between JD 2442958 (epoch -225.5) and 2447973 (epoch +2798); the new minima at epochs 3428 and 3431 are clearly inconsistent with the previous rate of period decrease.

it is impossible to represent the data from such a broad time interval by a single parabolic O-C curve. Instead, the minimum times were grouped into different data sets, for which piecewise constant period decrease rates were evident, and satisfactory representations could be achieved by quadratic O-C fits.

The two new minima were added to the last group F of photoelectric data, which now extends from J.D. 2442958 to 2449022 (1976 to 1993). Also, a recently published primary minimum by Rucinski et al. (1992) as well as two primary minima by Pfleiderer (1984), which had been omitted in the analysis of HD due to a somewhat lower timing accuracy, were now added to the data sample. Assuming the primary minimum of hel. J.D. 2443332.9780 (Kvíz, 1979) as epoch zero, and an initial period of $1.^d6588106$, the O-C values with respect to this linear ephemeris have been fitted to yield the new quadratic ephemeris formula:

$$\text{hel. J.D. (prim.)} = \underset{\pm .0149}{2443332.^d9634} + \underset{\pm 294}{1.^d6585895 \cdot E} \underset{\pm 0.8\cdot 10^{-8}}{- 7.0\cdot 10^{-8}\cdot E^2}$$

The parabolic fitting of the whole sample of minima is, however, relatively poor, since another fast shortening of the period seems to have happened during the last few years. Fig. 2 shows the parabolic fitting of the photoelectric minima of group F of HD, supplemented by the primary minima of Pfleiderer (1984) and Rucinski et al. (1992). The O-C values refer to a linear ephemeris J.D. $2443332.^d9780 + 1.^d6588106$. Secondary minima and the two primary minima by Pfleiderer have been weighted half as much as the other primaries due to their lower accuracy. It is apparent that the latest minima are no longer in accord with a constant period decrease rate over the time interval covered.The new primary minima at epochs 3428 and 3431 are clearly inconsistent with the previous decrease rate. If included in the fit, the standard deviation increases to a much larger value of $0.^d0229$, compared with $0.^d0043$ for the fit shown in Fig. 2 (epochs -225.5 to 2798.0). This value is still higher than expected for photoelectric timings. If the time interval is further restricted to the epoch range from -225.5 to 1409.0, the standard deviation, however, decreases to $0.^d0019$. Hence it can be anticipated that the period has shortened with time in a non-linear way after epoch 1409 (1983).

Between JD 2442958 (epoch -225.5) and JD 2447973 (epoch 2798), the mean value of $\dot{P}$ was $-5.22\cdot 10^{-8}$ corresponding to $\dot{P}/P \approx -1.15\cdot 10^{-5}\ \text{yr}^{-1}$. Including the new minima, the average value of $\dot{P}$ between JD 2442958 and 2449022 (epoch 3431) would amount to $-8.42\cdot10^{-8}$ or $\dot{P}/P \approx -1.85\cdot10^{-5}$ $yr^{-1}$, a value well above the long-term decrease rate of $-1.52\cdot10^{-5}$ $yr^{-1}$, indicating that another fast shortening of the period comparable to that of 1975 (see HD) has happened within the last 3 years. The actual period in February 1993 (epoch 3431) was $1.^{d}658109$ ($\pm 0.^{d}000030$), in accordance with a continued long-term decrease as extrapolated from Fig. 4 of HD.

The above new ephemeris will be applicable only for a relatively short time, since a major acceleration of the decrease rate had happened at the end of the time interval covered by the O-C fit. The further development of the period decrease has to be monitored carefully.

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References:

Herczeg, T., Drechsel, H.: 1985, Astrophys. Space Sci. 114, 1
Kvíz, Z.: 1979, New Zealand J. Sci. 22, 469
Kwee, K.K., van Woerden, H.: 1956, BAN 12, 327
Pfleiderer, J.: 1984, Inf. Bull. Var. Stars 2786
Rucinski, S.M., Baade, D., Lu, W.X., Udalski, A.: 1992, Astron. J. 103, 573