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The photometric history of the hypergiant V766 Cen = HR 5171a during the years 1953–1990

ABSTRACT

The light and colour curve of the $G8Ia^+$ hypergiant V766 Cen = HR 5171 A are presented and discussed.

INTRODUCTION

The hypergiant V766 Cen = HR 5171A = HD 119796 (in 1970 of spectral type $G8Ia^+$ according to Humphreys et al. (1971) has the galactic coordinates l = 309° b = -0°4.

It is a visual binary with a separation of 9"7. The spectral type of the companion (HR 5171B) is B0Ibp (Humphreys et al., 1971) and about 3^m fainter. Infrared studies demonstrate the presence of a circumstellar dust shell causing the pronounced 10μm silicate emission feature (Hagen et al., 1981; Pégourié and Papoular, 1985; Stickland, 1985).

Photometry is available since 1953 up to 1973, see for references van Genderen (1979), from 1975 up to 1979: Dean (1980) and from 1979 up to 1990: the present paper (VBLUW system, of which only V and V-B transformed into V_J and $(B-V)_J$ will be discussed).

LIGHT AND COLOUR CURVE. DISCUSSION

Figure 1 shows the light and colour curves V and B-V (with subscript J, to recognize them from the same indices of the VBLUW system). The object shows three important phenomena:

1. the increasing reddening from $(B-V)_J$ = 1.93 in 1953 up to 2.60 in 1990, while V_J dropped by ~0^m4 only. Obviously the cause is no increase of the circumstellar dust shell only. An evolutionary effect or a temporary expansion of the photosphere could also be partly the cause.

The interstellar reddening of HR 5171B is estimated to amount to $E(B-V)_J$ = 1.02 and of V766 Cen $E(B-V)_J$ = 1.13 and is based on their multi-photometric characteristics.

Figure 2 shows the HR diagram with the track of V766 Cen from 1953 up to 1990 adopting an interstellar and circumstellar reddening of 1.13, the red parts of the evolutionary tracks (M_i = $60M_\odot$) of Maeder (1981a,b) for mass loss cases B and C (dotted and dashes dotted lines), a few evolutionary tracks of Maeder and Meynet (1987) including overshooting (full lines) and the position of the blue companion (M_{bol} = -9.0 based on the tables of de Jager and Nieuwenhuyzen (1987), thus the distance r ~ 4.5 kpc).

Obviously the red turning point of the evolutionary track (M_i = $60M_\odot$) without overshooting fit the position of V766 Cen more or less, contrary to the track with overshooting. Due to the possible presence of a second supergiant companion close to V766 Cen, the true log L values of V766 Cen should be somewhat smaller: bracketed dot in Fig.2, see 2). If the change of V766 Cen is caused by evolution (this suggestion should be considered with great care until a new spectral determination has been made) the time scale is a few orders of magnitude too small compared with the theoretical time scale.

2. between 1973 and 1976 there is a deep minimum in the light curve of ≥ 1^m depth. The colour $(B-V)_J$ did not change much. Perhaps the colour was even slightly bluer during the minimum than before and after it. It is possible that we are dealing with an eclipse of the G type supergiant by a slightly bluer

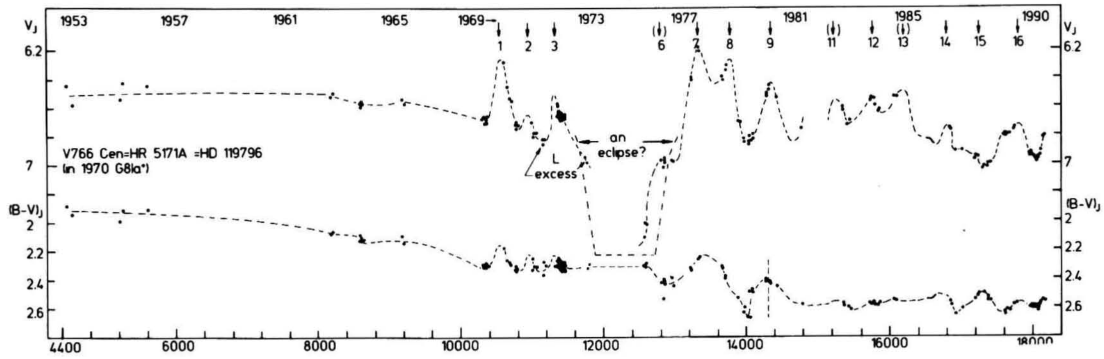

fig. 1. The light and colour curve of V 766 Cen

supergiant companion. Since no other eclipse is observed the period of revolution must be larger than 37 years.

3. the light and colour curves show oscillations with varying amplitudes. Amplitudes strongly increase to the shorter wavelenghts, a few times stronger than can be explained by temperature effects only.

The significant maxima are numbered 1 to 16 in Fig. 1. Maximum 15 is very pronounced in the short wavelenghts. Adopting that we missed the maxima with the numbers

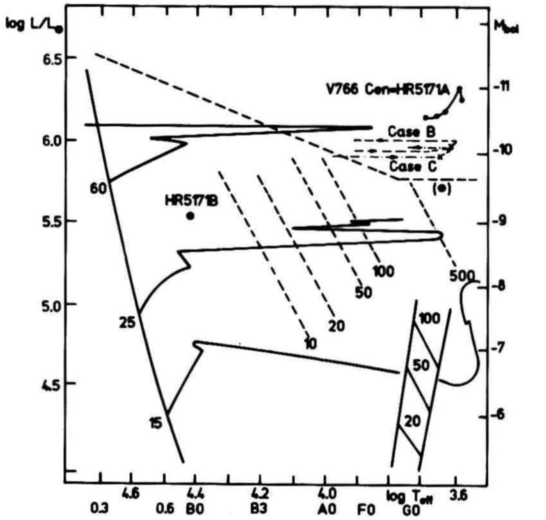

fig. 2. The theoretical HR diagram

4, 5 and 10, a least squares fit reveals that between 1972 (maximum 3) and 1990 (maximum 16) the period stayed constant:

$$JD_{max} = 2444292.7 + 494^{d}0\ E$$
$$\pm 12.2 + \pm 3.0 \text{ m.e.}$$

Standard deviation for the maxima: 38^{d}.Between the maxima 1,2 and 3 the period was shorter: - 430^{d}.

The fact that the period was stable during at least 18 years could mean that the cause is an imposed periodic force suggesting radial pulsation.

A few P = constant lines for variable supergiants according to Maeder (1980) are sketched in Fig. 2. (oblique dotted lines). The rather large distance of V766 Cen to the 500^{d} line must be mainly caused by the low reliability of the PLT_{eff} relation for extreme periods.

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