NATURE OF THE SYMBIOTIC BINARY V 1329 CYG

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Abstract. The published photometric and spectroscopic data of the symbiotic binary V 1329 Cyg are interpreted. It is shown, that V 1329 Cyg is an eclipsing binary with an elliptical orbit (e = 0.28). The cooler component fills up the Roche-lobe at periastron. A model of moving gaseous structures in the system is proposed and their influence on the radial velocity curve is shown. The following characteristics of the system are derived: the cooler component is an M6 giant with mass 7.9 $M_\odot$, radius 339 $R_\odot$ and luminosity $M_{bol} = -5.42$, the hot component is a white dwarf surrounded by an accretion disk. The mean distance between the components is 842 $R_\odot$ and in periastron it decreases to 605 $R_\odot$.

1. Introduction

Although 15 years have elapsed since the discovery (Kohoutek, 1969) of the symbiotic star HBV 475 = V 1329 Cyg, no clear picture of this object was built up to now. Several models were proposed to interpret the observations: a protoplanetary nebula (Crampton et al., 1970; Tamura, 1981a, b), a detached eclipsing binary system with a very massive $M$ bright giant primary and a compact secondary (Grygar et al., 1979; Iijima et al., 1981), a nova-like object with recurrent outbursts and a moving ionization front (Iijima and Mammano, 1981).

The aim of this paper is to show that the best explanation of the observational data is provided by an eclipsing binary model with an elliptical orbit. The system is semidetached in periastron with an accretion disk around the white dwarf. The work provides a proof of the existence of an outflowing stream from a turbulent region of the accretion disk onto the outer excretion disk. A moving nebula is present inside the Roche-lobe near the accretion disk as well as in the second Jacobian surface near the excretion disk. An observational proof of the existence of the secondary minimum is given.

2. Observational History and Models of the System

2.1. PHOTOMETRIC HISTORY

Old archival photographic photometry of the object was compiled by Stienon et al. (1974), who presented an evidence that in the years 1891–1963 the star V 1329 Cyg was fluctuating irregularly up to $\pm 1''$ around the mean value $m_{pg} \approx 15.1''$. On several
occasions a decrease of brightness up to $2.3^m$ was detected with an approximate periodicity of about 960 days. From these old photometric data Grygar et al. (1979) derived the following ephemeris:

$$T_{\text{Hecl J.D. (prim. min.)}} = 2424870 + 950^d E.$$  \hspace{1cm} (1)

They suggested that the duration of the primary minimum of the eclipsing binary was about 0.1 of the orbital period. The system flared-up in the years 1964–1966 when it attained its maximum brightness of $m_{pg} \approx 11.5^m$ and since then it started slowly the decline of brightness. The $B$ and $V$ phase light curves in the time interval J.D. 2440508–2444221 (containing the time of maximum brightness) are reproduced here as Figure 1 (see Iijima et al., 1981). When one compares the phase light curves before the flaring episode (see Grygar et al., 1979) and after it, two important conclusions can be made. First, the position of the primary minimum is preserved and second, the

![Fig. 1. V 1329 Cyg: B and V light curves (from the work Iijima et al., 1981).](image)