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HD 224113 - A NEW ECLIPSING, DOUBLE-LINED BINARY *

The optical variability of the B5 IV-star HD 224113 was discovered accidentally by the author in July 1978 at the ESO-site in La Silla/Chile. Up to that time this system was known as a single-lined spectroscopic binary (Archer and Feast, 1958). Subsequent uvby-photometry (ESO 50cm telescope) and spectroscopy in the blue, red and infrared region (1.5m telescope, mostly 12 A/mm) during August 1979 and 1980 revealed an Algol type light curve and led to the detection of the secondary spectrum on IIIa-J(B) plates. This offers now the opportunity

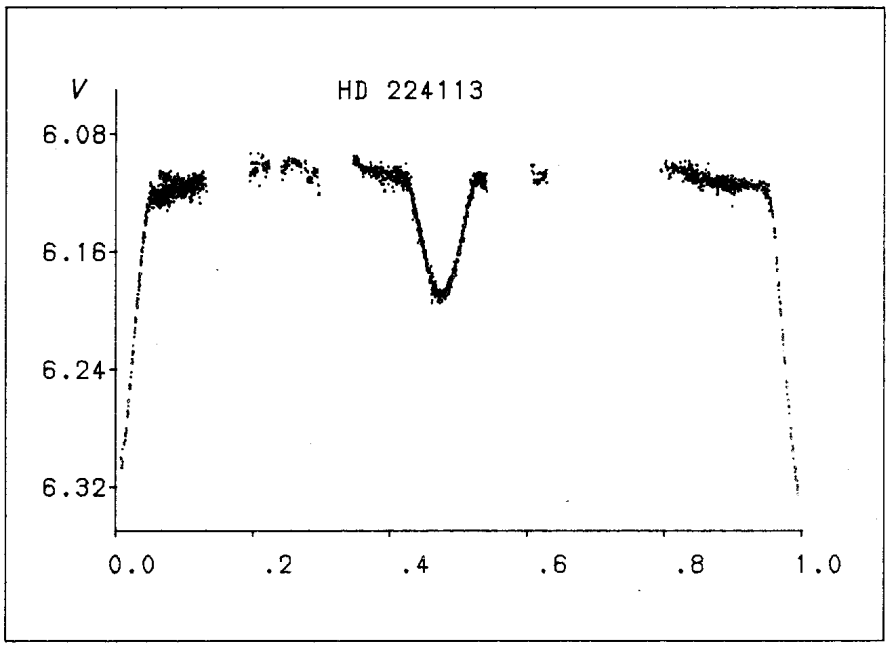

Fig. 1 The V-light curve

* based on observations collected at the European Southern Observatory.

to derive the dimensions of this system in absolute units which is especially important in the case of early type non-main sequence stars.

Fig. 1 shows the hitherto incomplete light curve (1970 measurements) transformed into the Johnson V-system. Both, the complete secondary minimum and the ascending part of the primary minimum, are measured in two observation runs with a time difference of about one year. Therefore a precise period could be derived which is slightly shorter than that previously known. The epoch of the primary minimum is given by the formula:

$$\text{HJD } 244\,3698.5118 + 2^{d}.445088E$$

The light curve clearly demonstrates some complications of the system: Reflection and ellipticity effects, and the influence of gas streams or circumstellar material are small but definitly present. Moreover the displacement of the secondary minimum to phase 0.476 indicates a non-zero eccentricity of the orbit in contradiction to Lucy and Sweeney (1971), who obtained a circular orbit recalculating the available spectroscopic data.

No rectification has been attempted because of the lack of sufficient data outside the minima. However, a fairly good representation of both minima could be obtained with the tentative parameters (Merrill-Russell method): $k = 0.44$, $r_2 = 0.103$, $i = 82^{o}$, $x = 0.6$. The well observed secondary minimum probably is an occultation very near to totality. (The minimum light of the primary minimum (transit) has been estimated to be around $6^{m}.325$ according to some V-measurements kindly provided by H.J. Schober).

Fig. 2 shows the radial velocity curves derived from the CaII-K-line only. This line is the only line of the secondary suitable for radial velocity measurements. Sometimes MgII 4481 seems also to be present. Besides that the secondary spectrum causes an asymmetry of the H-lines. From the spectral behaviour and the derived photometric elements one can estimate the spectral type of the secondary to be around AO. Some difficulties arise measuring the K-lines: The primary line is blended by an interstellar component (radial velocity 0.7 km/s) and the secondary line will be distorted for positive velocities by HeI 3936 of

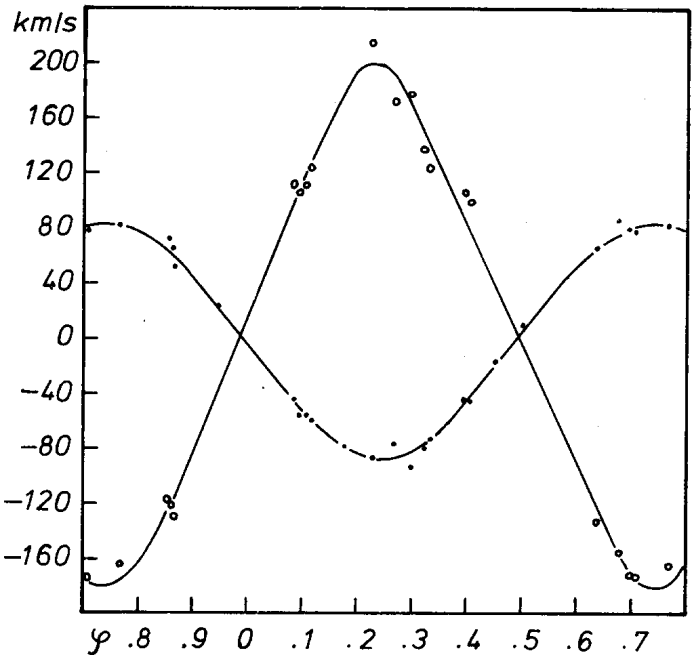

Fig. 2 The radial velocity curves, · primary, ∘ secondary

the primary (see Fig. 3). The elements found from these radial velocity curves are: K_1 = 86 km/s, K_2 = 190 km/s, γ = 2 km/s. There is a small difference ($\pm$ 3 km/s) for the γ-values of the individual curves which can be related to gas streams in the system. Whereas K_1 is in quite good agreement with the result by Archer and Feast, γ differs appreciable from their value (13 km/s). This may mainly be due to differences in the velocity systems but may also be a hint for a third body in the system. However, the value obtained for ω (mean from the two radial velocity curves and the light curve) amounts to 169° (refering to the primary) and agrees well with 167° found by Archer and Feast. Therefore the latter possibility must be ruled out. The orbital eccentricity has been determined to be e = 0.044. V-magnitude, semi-major axis, radius and mass for both components are given in Table I.

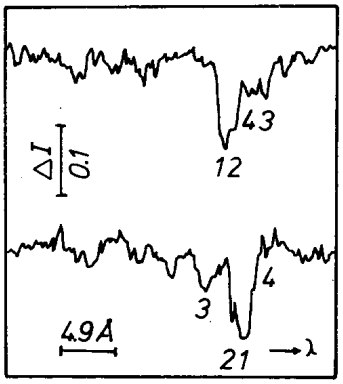

Fig. 3 Intensity tracings of the K-line region at two phases: ϕ = 0.30 (top) and ϕ = 0.68 (bottom). 1: K-line primary, 2: K-line interstellar, 3: K-line secondary, 4: HeI 3936.

Table I.

	Primary	Secondary
V	$6^m.20$	$8^m.96$
a	4.19 $R_\odot$	9.26 $R_\odot$
R	3.15 $R_\odot$	1.39 $R_\odot$
M	3.76 $M_\odot$	1.70 $M_\odot$

The preliminary results reported here will be used as initial parameters for the final evaluation by means of computer simulation after completing especially the photometric data.

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