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AMPLITUDE-WAVELENGHT DEPENDENCE FOR W UMa-SYSTEMS

It is well known that the amplitude of light change of a W UMa type system in blue region is larger than in yellow. Indeed, the first IR-observations of these systems (Jameson and Akinci, 1979) confirmed the existence of this regularity up to λ = 2.2 μm. The dependence of the amplitude difference ($A_V - A_\lambda$) on λ is shown in Figure 1. IR-data for this figure are given in Table I. Our observations of V 523 Cas were used for the optical range. In

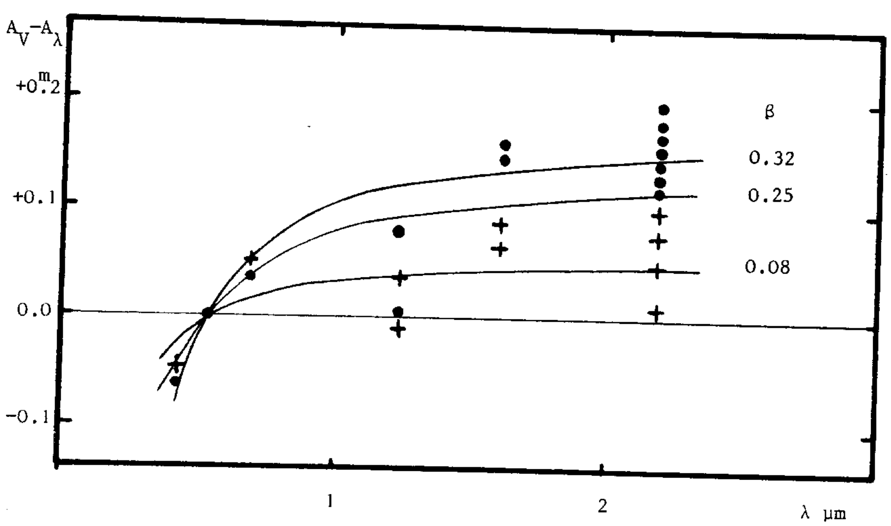

Figure 1

The observed dependence of the difference of the amplitudes ($A_V - A_\lambda$) on λ for the W-systems (min 1 is shown by dots, min 2 - by crosses). The theoretical curves (solid lines) for systems of spectral type KOV, filled up their Roche lobes, are shown for three values of β.

spite of the scattering of points a general character of the dependence may be revealed by the diagram: a sharp decrease of the difference of amplitude in the range up to 1 μm and more smooth change of the ($A_V - A_\lambda$)-value at λ > 1 μm. The observations of W UMa by Philips et al. (1980) give larger

Table I

System	Min	A_V	A_H	A_K	A_V-A_H	A_V-A_K	IR-data from:
W UMa	1	$0^m.73$	$0^m.43$	$0^m.43$	$0^m.25$	$0^m.25$	Philips et al. (1980)
	2	0.64					
	1	0.73	0.59	-	0.14	-	Shenavrin and
	2	0.64	0.55	-	0.09	-	Zhukov (1984)
AB And	1	0.82	-	0.68	-	0.14	Jameson and
	2	0.67	-	0.66	-	0.01	Akinci (1979)
SW Lac	1	0.78	-	0.66	-	0.12	"
	2	0.72	-	0.63	-	0.08	
VW Cep*	1	0.48	0.32	0.33	0.16	0.15	Shenavrin and
	2	0.38	0.31	-	0.07	-	Zhukov (1984)
	1,2	-	-	0.28	-	0.20	Lunel et al. (1982)
44i Boo*	1	0.61	-	0.47	-	0.14	Jameson and
	2	0.49	-	0.44	-	0.05	Akinci (1979)
	1	0.61	-	0.41	-	0.20	Bergeat et al. (1981)
	2	0.49	-	0.39	-	0.10	

* - the third light is taken into account

values of (A_V-A_λ) for W UMa in comparison with other systems. The reason of this may be explained by using the optical observations made non-simultaneously with IR ones and by a comparatively low precision of early IR-observations. In any case, our observations of W UMa in H-band do not show such deviation (Shenavrin and Zhukov, 1984). Zhukov and Chruzina (1983) computed theoretical light curves for W UMa-systems permitting to obtain the theoretical dependence (A_V-A_λ) which is shown in Figure 1 by solid lines (due to special features of the computer this dependence is suitable for interpretation of data only for primary minima of W-systems). As it is seen from Figure 1, theoretical dependence satisfactorily imitates the observations assuming that primaries fill up their Roche lobes and the gravitation darkening coefficient is $\beta \geq 0.25$. $(A_V-A_\lambda)_2$ -dependence for secondary minima has a less steep slope. It is well seen from Figure 2 which represents the dependence of (A_1-A_2) amplitude difference on λ in primary and secondary minima.

Different behaviour of the dependences (A_V-A_λ) for min 1 and min 2 in infrared range can be explained by different temperatures of the components. But in this case, the observed dependence $(A_V-A_\lambda)_2$ must have quite different behaviour even if ΔT = 100-200 K. Our calculations show that the dependence (A_V-A_λ) becomes weaker if the components do not fill up their Roche lobes. Thus the different degree of the accretion of the lobes of the components may be a cause of the decrease of (A_1-A_2)-value in the IR-range. The last suggestion, however, needs further confirmation.

The difference in the depths of minima which reaches maximum value in optical range again decreases in UV-range (UV light curves of W UMa by Eaton

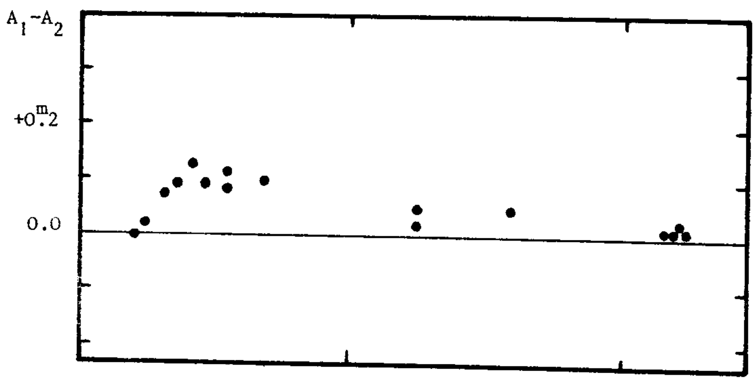

Figure 2. The observed dependence of the amplitude difference in primary and secondary minima (A_1-A_2) on λ.

et al. (1980) were used by us). One can explain this neither by different temperatures nor different geometry of the components. However, if UV-excess in some W UMa-systems will be related mainly to the inner atmosphere of primary, one can try to explain the observed decrease of the amplitude differences of minima in UV-range with an eclipse of regions, causing this excess (it happens in secondary minima).

Conclusions

1. In all investigated systems (W-type only) the amplitude of the light change decreases with the increase of λ.

2. This dependence (A_V-A_λ) essentially differs for primary and for secondary minima.

3. The observed dependence (A_V-A_λ) as a whole can be explained with different geometry of the components, assumed $\beta \geq 0.25$ in addition. With $\beta = 0.08$ the necessity appears to include some additional factor which decreases the amplitude of the variability of W UMa-stars in IR-region. Accurate observations at $\lambda > 2$ μm are needed to resolve this problem. Then the cause of IR-excess in W UMa-systems would be clear.

4. The magnetic activity of W-system's primaries which is connected with a considerable UV-excess is a probable reason of (A_1-A_2)-value decrease in UV-range.

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