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INFRARED OBSERVATIONS OF THE BINARY STARS W UMa AND VW Cep

The binary stars W UMa and VW Cep are well known contact systems. A large number of observations of the first system in different bands allows this star to be used for the examination of any hypotheses. So UV-observations by Eaton et al., (1980) permitted to conclude on the equality of the temperatures of both components in W UMa. VW Cep is characterized by a marked photometric activity, i.e. with considerable changes of the light curve.

Some IR light curves of W UMa type systems have been obtained recently. But only 44i Boo (Bergeat et al., 1981) has high-quality IR light curves, comparable to optical ones. Our observations of W UMa and VW Cep at λ = 1.62 μm have been made with a PbS photometer at the Cassegrain focus of the 1.25 m

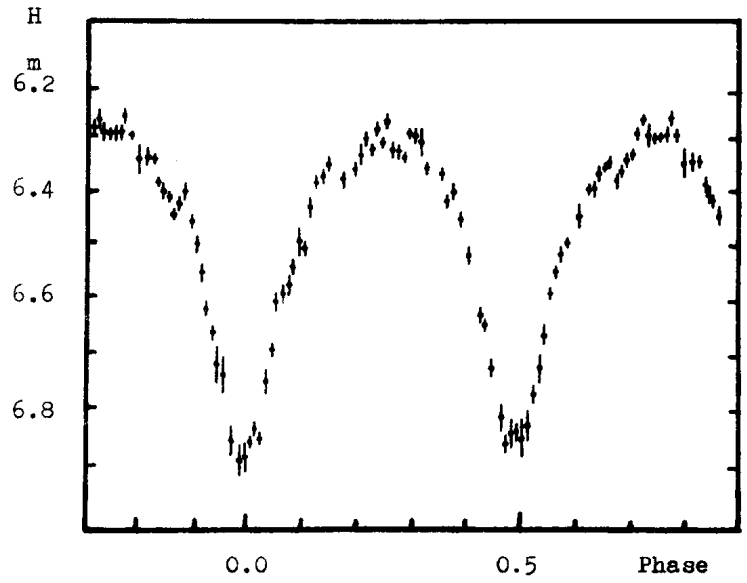

Figure 1

reflector of Crimean Station of Sternberg Astronomical Institute.

W UMa More than 600 observations of this system were obtained between January and April, 1982. The mean light curve is given in Figure 1. HD 84335 served as a comparison star and IR-values of BS 3775 were used as a standard. IR-magnitudes of the variables and the comparison stars are given in Table I.

Table I

Star \ Band		J	H	K
W UMa,	max	$6^m.39$	$6^m.29$	$6^m.20$
	min 1	-	6.87	6.71
	min 2	-	6.83	-
HD 84335		-	0.62	0.34
VW Cep,	max	-	5.42	5.20
	min 1	-	5.67	5.45
	min 2	-	5.66	5.49
HD 196502		-	5.25	-

Their precision as well as that of the mean light curves is $\pm 0^m.01$ ÷ $0^m.02$.

During the period of observation W UMa was in active phase. It is followed from the optical observations by Hamzaoglu et al., (1982 a, 1982 b) namely the primary minimum was deeper than the secondary one in January but depths of minima were almost equal in April. The distortions of H-curve also point out the activity. They have the amplitude up to $0^m.05$. These distortions are undoubtedly caused by the existence of circumstellar matter in the system in the epoch of the observations. The light depressions of H-curve in phases 0.15-0.25 and 0.67-0.72 are provided with the blueing of (B-V) colour by $0^m.01$ ÷ $0^m.02$.

VW Cep The observations of this binary have been made in H- and K-bands in 1981. HD 196502 served as a comparison star and IR-magnitudes of BS 7685 were used as a standard. However, the sensitivity of the detector is small at λ = 2.2 μm and therefore a reliable curve could not be obtained (Figure 2). The mean H-curve is given in this figure too. The lesser number of the observations (275) does not allow to obtain as a detailed light curve as W UMa has. The considerable asymmetry of minima is, however, noteworthy.

IR-data of the above binaries conform to spectral types F6-F8 III and G5 III for W UMa and VW Cep, correspondingly (Straizys, Sviderskiene, 1972). Thus the variables have an IR-excess.

The decrease of the light change amplitude with increasing λ which has been discovered for a series of W UMa systems by Jameson and Akinci (1979) is $0^m.14$ for W UMa and $0^m.16$ for VW Cep according to our investigations (last value is corrected for the third component discovered by Heinz (1975)). The

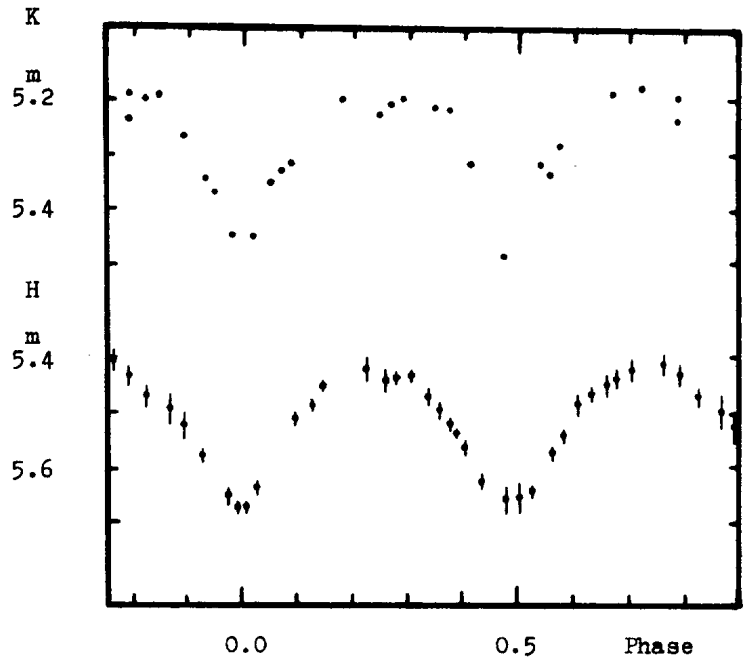

Figure 2

close value $(A_V - A_K) = 0^m.20$ was obtained from the observations of Lunel et al., (1982) for VW Cep. So, the decrease of the amplitude in IR-range in comparison with optical observations by $0^m.15 - 0^m.20$ is the characteristic feature of W UMa systems. Fourier analysis of the noneclipsed parts of optical light curves, (Kwee, 1966) and of our IR-curve of VW Cep shows that $A_2 \cos 2\theta$ term is responsible for the change in the amplitude. A_2-value is -0.14 in B-band and -0.06 at λ = 1.62 μm.

The next conclusions can be drawn from our observations. The eclipsing binaries W UMa and VW Cep have an IR-excess. The depressions of IR light curve of W UMa point out the possible presence of circumstellar matter in the system similar to a jet which is throwed away from the primary. The decrease of the light change amplitude with increasing λ is probable connected with the geometry of the components, the latter is supported by the behaviour of the limited Fourier row. Probably there is the "third" light - a cool cloud

which the W UMa systems are dipped in. However, the observations at $\lambda > 2.2$ μm are needed to sort the matter out.

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