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V 1125 Oph : TYPE AND PERIOD

SUMMARY
V 1125 Oph is an EB eclipsing binary whose period elements correspond to HDJ 38900.589 + 0.911618 d x E. Its magnitude is ranging from 11.20 to 11.68 in the CCD magnitude scale of the Rotse1 survey with min II = 11.42.

RESUME
V 1125 Oph est une binaire à éclipses du type EB, dont les éléments de la période correspondent à JJH 38900.589 + 0.911618 j x E. Sa magnitude va de 11.20 à 11.68 selon l'échelle de magnitudes CCD des observations Rotse1 avec un min II = 11.42.

SOMMARIO
V 1125 Oph è una binaria ad eclisse del tipo EB, i cui elementi fotometrici corrispondono a : HJD 38900.589 + 0.911618 d x E. L'ampiezza della variazione è compresa tra le magnitudini 11.20 e 11.68 (minimo secondario a 11.42) nella banda misurata dal sistema Rotse1.

RESUMEN
V 1125 Oph es una bineria eclipsante de tipo EB cuya efeméride es DJH 38900.589 + 0.911618 d x E. Su luminosidad varía entre las magnitudes 11.20 a 11.68 segun la escala de magnitudes CCD de Rotse1, con min II = 11.42.

1. INTRODUCTION

V 1125 Oph = GSC 983 1883 = J165505.96+113304.1 (16h 55min 11s +11° 31.2' ; 2000) was found to be an eclipsing star with magnitude 11 to 11.5 (p) by C. Hoffmeister (1968) who listed three instants of minima (see Table 1).

In 1990, J. Vandenbroere began to observe V 1125 Oph visually and in 1993 M. Benucci also included this star in his visual observation program. Indeed at that time, the period searches displayed a very probable apparent period of 0.9116 day (Vandenbroere, 1994), but the estimates were not sufficiently numerous and accurate to determine the actual rotational period of the system without any doubt.

Afterwards, V 1125 Oph entered the priority program of GEOS and new visual estimates were gathered allowing the publication of a second note (Vandenbroere, 1996). In that note, the system rotational period of 0.9116 day could be established. 17 visual instants of minimum were published, but the linking up of these instants with those of C. Hoffmeister was still a first attempt.

2. ELEMENTS OF THE PERIOD

The ancient observations combined with the new ones permit us now to calculate the rotational period of V 1125 Oph with great accuracy.

At the end of 2001, we have 1625 visual estimates obtained by eight GEOS observers : Jacqueline Vandenbroere (VBR) 603, Jean-Paul Verrot (VRR) 561, Mino Benucci (BEN) 155, Bernard Paris (PAR) 101, Mario Checcucci (CHC) 74, Massimiliano Martignoni (MRT) 74, Michel Dumont (DMT) 50 and Andrea Manna (MAA) 7. From these observations, 29 instants of minimum could be determined with reasonable accuracy (see Table 1).

V 1125 Oph was also one of the targets of the Rotse1 survey (Robotic Optical Transient Search Experiment 1) in 1999. With the 74 CCD measurements of that survey, available through internet (http://www.umich.edu/~rotse), we can determine 4 additional instants of minimum (see Table 1).

Table 1 : The photographic (phot), visual (vis) and CCD instants of minimum of V 1125 Oph used to obtain ephemeris 1

OBSERVER	MODES	HDJ (2400000+)	E	O-C
HOF	phot	38901.490	1	- 0.010
HOF	phot	39262.490	397	- 0.011
HOF	phot	39263.460	398	+0.047
VBR	vis	48014.426	997.5	- 0.060
VBR	vis	48484.445	10513	+0.021
VBR	vis	48756.489	10811.5	- 0.053
VBR	vis	49212.351	11311.5	+0.000
VBR	vis	49222.398	11322.5	+0.019
BEN	vis	49479.461	11604.5	+0.006
BEN	vis	49510.428	11638.5	- 0.022
BEN	vis	49511.387	11639.5	+0.025
VBR	vis	49593.405	11729.5	- 0.002
VRR	vis	49892.379	12057.5	- 0.039
DMT	vis	49906.525	12073	- 0.023
VBR	vis	49922.472	12090.5	- 0.029
VBR	vis	49923.399	12091.5	- 0.014
VRR	vis	49924.326	12092.5	+0.002
VRR	vis	49933.461	12102.5	+0.20
VBR	vis	49934.377	12103.5	+0.025
CHC	vis	49944.359	12114.5	- 0.021
VRR	vis	49954.417	12125.5	+0.009
VBR	vis	50200.525	12395.5	- 0.019
VBR	vis	50634.497	12871.5	+0.023
CHC	vis	50656.358	12895.5	+0.005
VRR	vis	50687.354	12929.5	+0.006
PAR	vis	50954.442	13222.5	- 0.010
PAR	vis	50955.374	13223.5	+0.010
VRR	vis	51012.385	13286	+0.045
ROT	CCD	51259.383	13557	- 0.005
ROT	CCD	51295.393	13596.5	- 0.004
ROT	CCD	51307.256	13609.5	+0.008
ROT	CCD	51312.255	13615	- 0.007
VBR	vis	51346.471	13652.5	+0.023
VRR	vis	51420.319	13733.5	+0.030
VRR	vis	51430.339	13744.5	+0.022
VBR	vis	51733.413	14077	- 0.016

We made a first linear regression with the visual and CCD instants in order to obtain the accuracy required to allow us to go backwards down to the ancient instants of C. Hoffmeister. We used the folded light curve of the Rotse1 CCD measurements (see Fig. 1) to discriminate between primary and secondary minima. The final linear regression with all the 36 instants listed in Table 1 gives the following ephemeris :

$$\text{Min I} = \text{HJD } 24389.589 + 0.9116176\ d \times E \quad (1)$$
$$\pm 0.008 \pm 0.0000024$$

3. TYPE OF ECLIPSING BINARY

The eclipsing type of V 1125 Oph had already been noted in Hoffmeister (1968). It is confirmed without any ambiguity with the folded light curve of the Rotse1 CCD measurements (see Fig. 1) which shows that the star varies with alternating two minima of different depths and that the maxima are rounded. Thus, it is surely not an EA type binary.

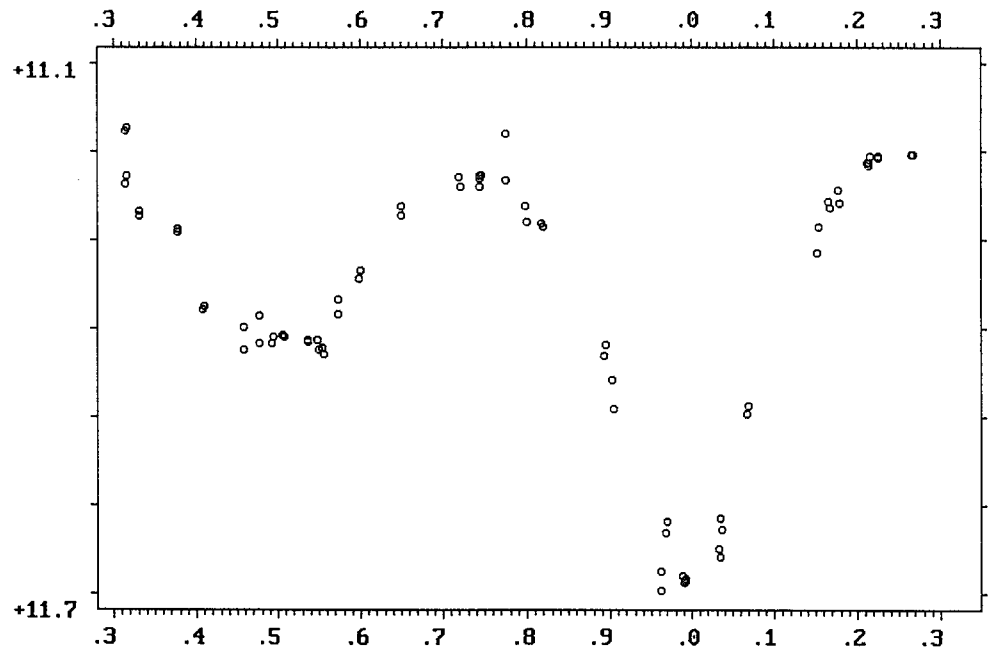

Figure 1 : Light curve of V 1125 Oph with the 74 CCD measurements of Rotse1 folded with ephemeris (1)

We have further information from several observations made with R. Boninsegna at Jungfraujoch observatory before the removing of the photometer (see Table 2). Four measurements of V 1125 Oph were obtained in each of the B and V filters (Geneva system) with the photometer attached to the 76-cm telescope of the station. The measurements are close to minimum I. The $(B-V)_G$ indices have been transformed into the UBV system assuming a luminosity class V. They correspond to the colour of main sequence stars with F spectrum and it is inferred that V 1125 Oph is more blue outside primary eclipse.

HJD (2400000+)	MAGNITUDES V	$(B-V)_G$ INDICES	$(B-V)_J$ INDICES	PHASES
49577.4351	11.219	- 0.389	0.469	0.979
49577.4378	11.213	- 0.376	0.479	0.981
50342.3476	11.202	- 0.417	0.446	0.051
50342.3594	11.177	- 0.409	0.452	0.063

Table 2 : The photoelectric measurements of V 1125 Oph (phases are relative to ephemeris (1)

In Fig. 1, we can see that, in the Rotse1 magnitudes, V 1125 Oph is ranging from 11.20 to 11.68 at min I and to 11.42 at min II with an O'Connell effect (different depths of the two maxima) of 0.03 mag.

With a period of 0.9116176 day, an amplitude of light variation of 0.48 mag. and a difference between min I and min II of 0.26 mag., V 1125 Oph is very probably not an EW contact binary and it can be put into the EB type of semi-detached systems with components close to the inner critical Roche lobe (Rucinski, 1997). The asymmetry of the maxima can be due to one (or more) spot on stars with spectrum F or later (one of the components is surely of the required colour) or it can be caused by mass transfer in semi-detached systems of similar type with a correlation between the direction and size of the asymmetry and the difference in the depths of eclipses, the maximum after the deeper eclipse indicating infalling material on the cooler component as the most likely direction of the gas streaming (Rucinsky, 1997).

4. CONCLUSION

V 1125 Oph is an interesting eclipsing star too poorly observed because there are not many EB stars with periods shorter than one day.

5. BIBLIOGRAPHY

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