COMMISSIONS 27 AND 42 OF THE IAU
INFORMATION BULLETIN ON VARIABLE STARS
Number 5926

Konkoly Observatory
Budapest
12 February 2010
HU ISSN 0374 – 0676

8 RR LYRAE STARS WITH VARIABLE PERIODS

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No ephemerides were published for the stars analysed in this paper except for V870 Oph, V878 Oph and V964 Oph. Elements of these three stars, published and included in the General Catalogue of Variable Stars (Samus et al., 2009) were found to be erroneous. Indications of more or less intense period variations were detected in all cases.

Photographic plates of fields centered around α Oph, κ Oph and 67 Oph, taken with the Sonneberg Observatory 40cm Astrograph during several intervals spread over the years from 1938−1994, were used to check the behaviour of these objects (see Table 1). The elements listed below were obtained by means of least-squares solutions.

Straight lines in the (O−C) diagrams mark the scopes of the linear subsets according to Table 1.

Photographic amplitudes were derived with respect to magnitudes of the comparison stars given in Table 2. An extensive list holding the times of the new found maxima can be retrieved as `5926-t3.txt`, using the link in the HTML version of this paper. Individual data are available upon request.

Remarks:

V558 Her

Discovered by Hoffmeister (1967). The data in the (O−C)-diagram were calculated using mean linear elements

$$\text{Max. J.D. hel} = 2438524.597 + 0\overset{\text{d}}{.}473106 \times \text{E}$$

A sinusoidal fit is also possible for the whole range of observations.

$$\text{Max. J.D. hel} = 2438524.525 + 0\overset{\text{d}}{.}473106 - 0\overset{\text{d}}{.}074 \times \sin(0.000306 \times E - 2.12)$$

Elements listed in Table 1 are valid for J.D. 2438500−2441200, J.D. 2441200−2446700 and 2446700−2449500 resp.

V762 Oph

Discovered by Boyce and Huruhata (1942). Although a precise time of the period change can not be deduced from the (O−C)-diagram, the composite light curve drawn with these period values gives some hints to assume a period change took place around J.D. 2440000. Elements are at least valid for J.D. 2438500−2440000 and J.D. 2440000−2449500, resp.

V771 Oph
Discovered by Luyten (1937). Subtle to observe due to a close and bright neighboring star. Elements are at least valid for J.D. 2438000−2442000 and J.D. 2442000−2449500, resp.

V870 Oph
Independently from Boyce and Huruhata (1942) discovered by Hoffmeister (1949). Elements derived by Götz et al. (1957) have turned out to be inaccurate. Götz's observations made on Astrograph plates have been reexamined; those made with the 170mm Triplet (Designation "A" in the paper of Götz et al.) have been included in our analysis to enlarge the time base to derive the first subset of elements.
Elements listed in Table 1 are valid for J.D. 2425000−2429000, J.D. 2429000−2438000 and 2438000−2449500 resp.

V878 Oph
Type of variability and first elements derived by Götz et al. (1957) have turned out to be wrong. The elements given below are at least valid for J.D. 2429000−2432000 and J.D. 2438500−2449500, resp. Unfortunately there were no plates available in between these times. So, the (O–C)-diagram represents only one reasonable version of the star's period history.

V964 Oph
Elements derived by Götz et al. (1957) are not accurate and the period has to be halved. The elements given below are at least valid for J.D. 2429000−2444100 and J.D. 2443000−2449500, resp.

NSV 8590
Discovered by Boyce and Huruhata (1942). Subtle to observe due to a close neighboring star. Coordinates published in the General Catalogue of Variable Stars (Samus et al., 2009) are improper; right position is 17:23:55 +09:46:39 (2000.0). The elements given below are at least valid for J.D. 2438500−2440000 and J.D. 2440500−2449500, resp.

NSV 9613
ASAS measurements were included in this analysis. The preliminary ID refers to the paper of Grubissich (1958). The elements given below are at least valid for the intervals of JD 2429000−2447000 and J.D. 2447000−2453600.

Table 1. Summary of this paper

Star	Type	Epoch 2400000+	Period (day)	Max.	Min.	M−m	No. of Plates
V558 Her (1)	RRab	39299.513 ±6	0.473134 ±3	$14^{m}.3$	$15^{m}.8$	$0^{p}.22$	87
V558 Her (2)		45871.424 ±7	0.473093 ±2				119
V558 Her (3)		49214.409 ±4	0.473117 ±1				38
V762 Oph (1)	RRab	38503.558 ±5	0.499951 ±7	$14^{m}.6$	$16^{m}.0$	$0^{p}.30$	80
V762 Oph (2)		48357.608 ±27	0.500021 ±6				130
V771 Oph (1)	RRab	38524.550 ±13	0.460735 ±3	$13^{m}.2$	$14^{m}.4$	$0^{p}.25$	103
V771 Oph (2)		49484.449 ±18	0.460822 ±3				188
V870 Oph (1)	RRab	29786.507 ±16	0.320631 ±2	$15^{m}.1$	$16^{m}.2$	$0^{p}.25$	
V870 Oph (2)		38258.409 ±8	0.320735 ±1				42
V870 Oph (3)		48356.584 ±13	0.320729 ±1				120
V878 Oph (1)	RRab	29785.521 ±2	0.633563 ±1	$14^{m}.9$	$16^{m}.0$	$0^{p}.22$	42
V878 Oph (2)		49124.465 ±8	0.633573 ±1				112
V964 Oph (1)	RRc	29790.439 ±6	0.254484 ±1	$15^{m}.0$	$16^{m}.1$	$0^{p}.30$	112
V964 Oph (2)		44022.482 ±13	0.254488 ±1				64
NSV 8590 (1)	RRab	38553.533 ±11	0.493591 ±14	$14^{m}.1$	$14^{m}.7$	$0^{p}.19$	81
NSV 8590 (2)		42988.453 ±24	0.493515 ±4				180
NSV 9613 (1)	RRab	29813.509 ±34	0.574765 ±2	$15^{m}.0$	$15^{m}.5$	$0^{p}.25$	160
NSV 9613 (2)		49475.521 ±9	0.574744 ±2				32

Table 2. Comparison stars and cross references

	V558 Her S 9827 USNO 0975-09760289		V762 Oph HV 10940 USNO 0975-09206057	
Comp. No.	USNO	m*	USNO	m*
1	0975-09754037	$14^{m}.4$	0975-09206984	$14^{m}.8$
2	0975-09754926	$14^{m}.8$	0975-09205488	$15^{m}.4$
3	0975-09756549	$15^{m}.5$	0975-09205008	$16^{m}.3$
4	0975-09758451	$16^{m}.4$		

	V771 Oph 183.1937 USNO 0975-09337118		V870 Oph HV 11042 / S 4181 USNO 0900-10501915	
Comp. No.	USNO	m*	USNO	m*
1	0975-09338753	$12^{m}.9$	0900-10502097	$14^{m}.8$
2	0975-09338860	$13^{m}.7$	0900-10503177	$15^{m}.3$
3	0975-09333498	$14^{m}.8$	0900-10504815	$16^{m}.7$

	V878 Oph S 4221 USNO 0900-12249555		V964 Oph S 4219 USNO 0900-12201787	
Comp. No.	USNO	m*	USNO	m*
1	0900-12233849	$14^{m}.4$	0900-12191210	$14^{m}.5$
2	0900-12249979	$15^{m}.1$	0900-12198837	$15^{m}.2$
3	0900-12242643	$15^{m}.9$	0900-12203760	$15^{m}.8$
4	0900-12243574	$16^{m}.4$	0900-12199688	$15^{m}.9$

	NSV 8590 HV 10935 USNO 0975-09152532		NSV 9613 3(SA 109) USNO 0900-10436490	
Comp. No.	USNO	m*	USNO	m*
1	0975-09147252	$13^{m}.8$	0900-10431734	$14^{m}.9$
2	0975-09149633	$14^{m}.4$	0900-10436319	$15^{m}.1$
3	0975-09151256	$14^{m}.6$	0900-10440956	$15^{m}.5$
4	0975-09154060	$14^{m}.8$		

* Magnitudes refer to the B values of the USNO−A2.0 catalogue

This research made use of Aladin and the SIMBAD data base, operated at CDS, Strasbourg, France.

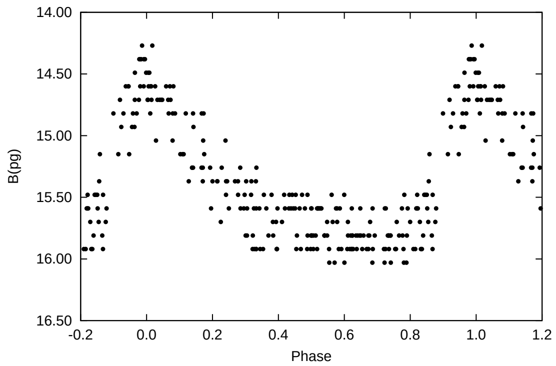

Figure 1. Composite light curve of V558 Her

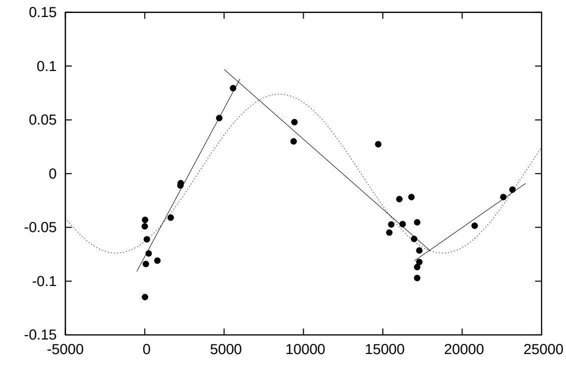

Figure 2. (O−C) diagram for V558 Her

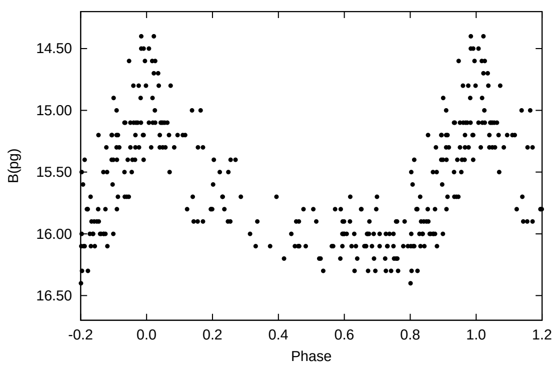

Figure 3. Composite light curve of V762 Oph

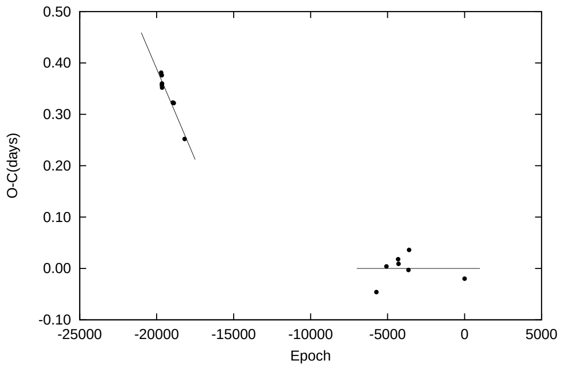

Figure 4. (O−C) diagram for V762 Oph

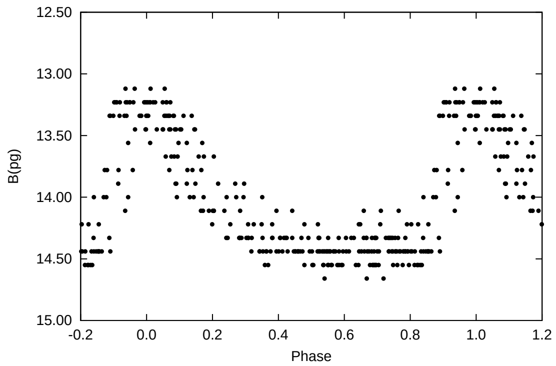

Figure 5. Composite light curve of V771 Oph

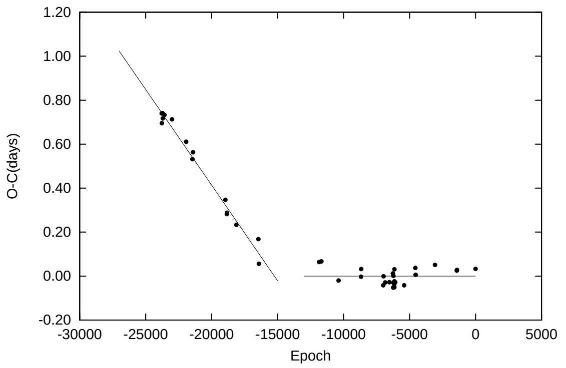

Figure 6. (O−C) diagram for V771 Oph

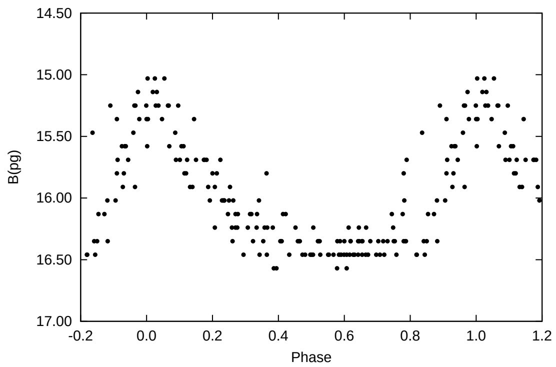

Figure 7. Composite light curve of V870 Oph

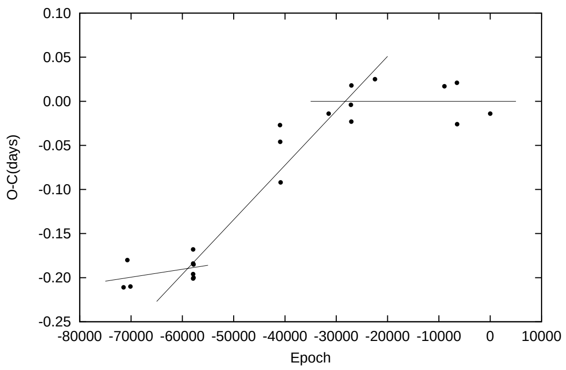

Figure 8. (O−C) diagram for V870 Oph

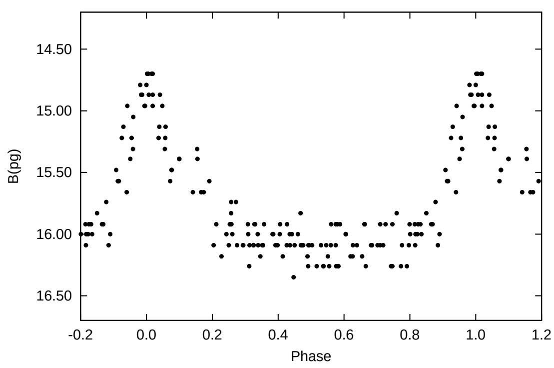

Figure 9. Composite light curve of V878 Oph

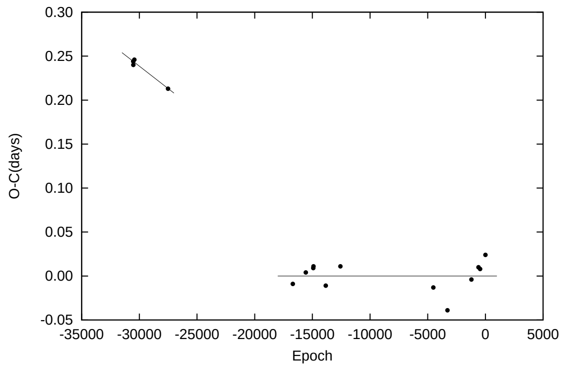

Figure 10. (O−C) diagram for V878 Oph

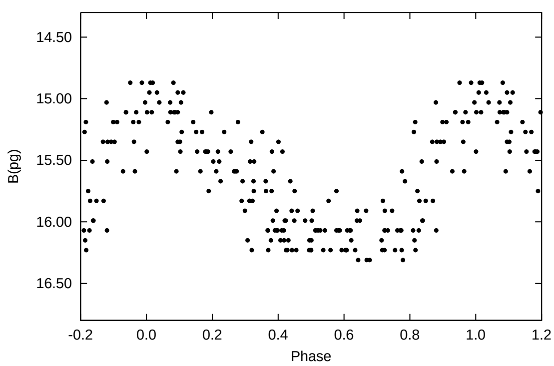

Figure 11. Composite light curve of V964 Oph

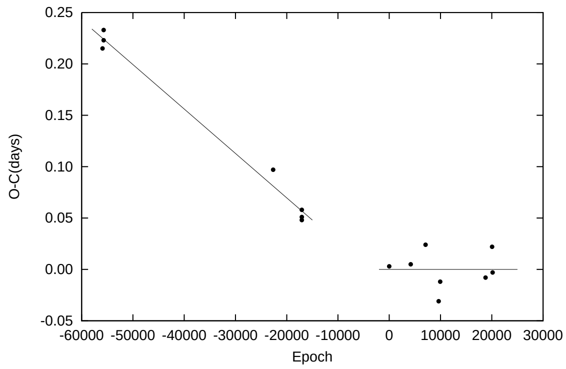

Figure 12. (O−C) diagram for V964 Oph

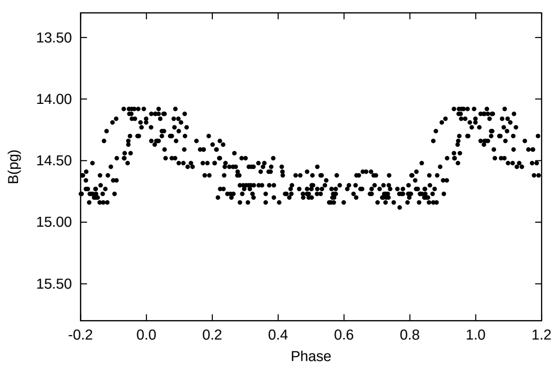

Figure 13. Composite light curve of NSV 8590

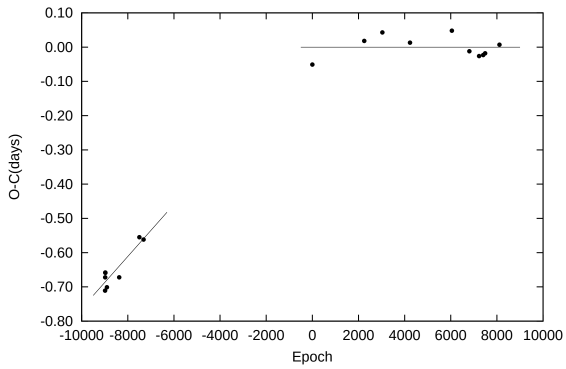

Figure 14. (O−C) diagram for NSV 8590

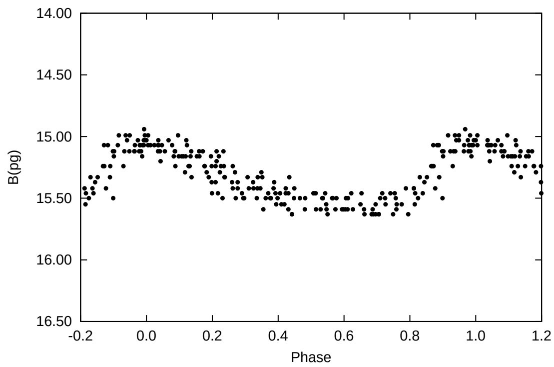

Figure 15. Composite light curve of NSV 9613

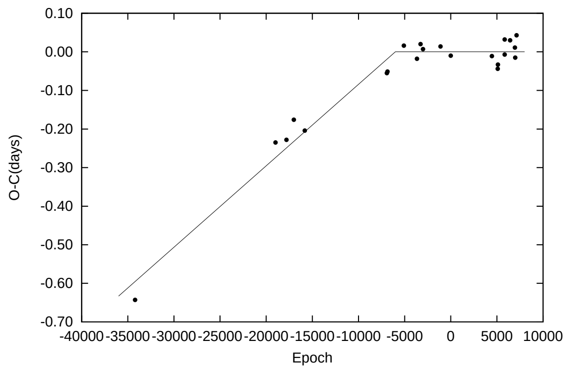

Figure 16. (O−C) diagram for NSV 9613

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