

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

Number 5580

Konkoly Observatory
Budapest

9 December 2004

HU ISSN 0374 – 0676

THREE RR LYRAE STARS WITH VARIABLE PERIODS IN OPHIUCHUS

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These stars were reported to be variable by Hughes-Boyce and Huruhata (1942) and Hoffmeister (1931, 1968). No ephemerides were published for V824 Oph and V2030 Oph until today whereas the elements for V530 Oph listed in the GCVS are erroneous. Photographic plates of a field centered around 67 Oph, taken with the Sonneberg Observatory 40cm Astrograph during three intervals spread over the years from 1938 to 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.

Photographic amplitudes were derived with respect to magnitudes of the comparison stars given in Table 2. Individual data are available upon request.

Remarks:

V530 Oph

The elements for V530 Oph published by Hoffmeister (1943) were based on an alias period (0^d3995). Times of maxima published in his paper were included in our period analysis and therefore also listed in Table 4. Maxima from 2429785-2429845 were reinvestigated from the plate series.

Elements valid for J.D. 2425500-2431700 and J.D. 2438200-2449500 resp.

V824 Oph

Elements valid for J.D. 2429100-2438500 and J.D. 2438500-2449500 resp.

The brightness of the star is just above the plate limit, so the true minimum magnitude might be somewhat below of the value given in the summary (see light curve). Five times of maxima observed around J. D. 2438500 were also used to derive a meaningful period value for the first set of elements. Despite this is quite arbitrary, it has turned out to be the only method to include the early observations in a good composite light curve as shown in Fig. 4. For this reason, ephemeris [1] should be used as preliminary because the true period change might be stronger than derived in this paper.

V2030 Oph

Elements valid for J.D. 2429100-2441200 and J.D. 2443300-2449500 resp.

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

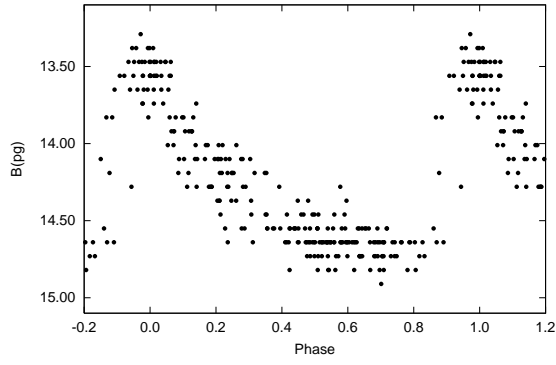


Figure 1. Composite light curve of V530 Oph

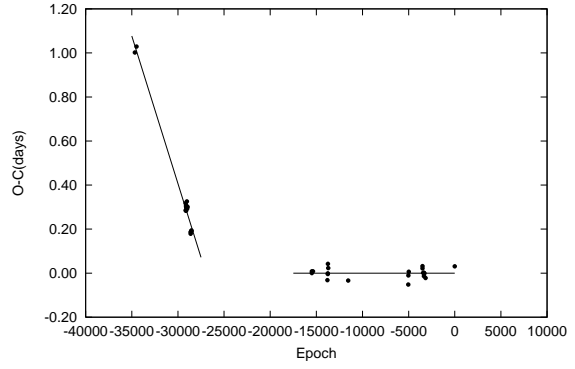


Figure 2. (O-C[2]) diagram for V530 Oph

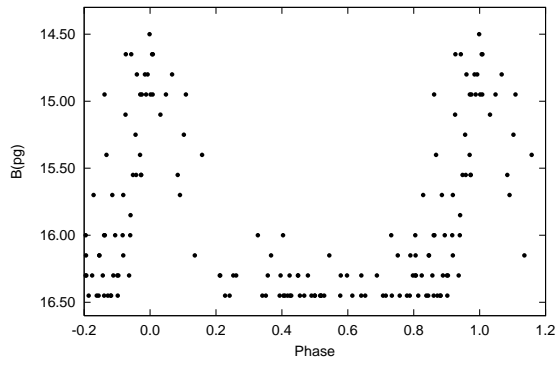


Figure 3. Composite light curve of V824 Oph

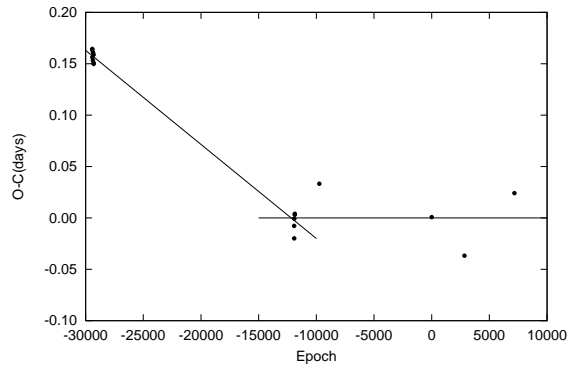


Figure 4. (O-C[2]) diagram for V824 Oph

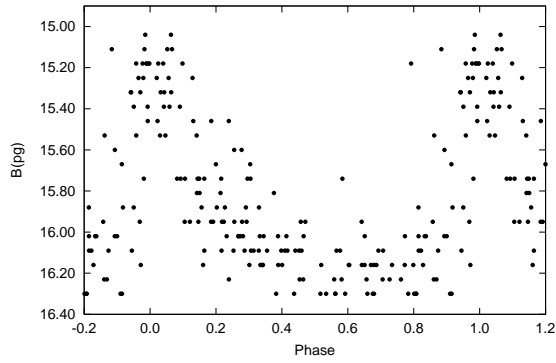


Figure 5. Composite light curve of V2030 Oph

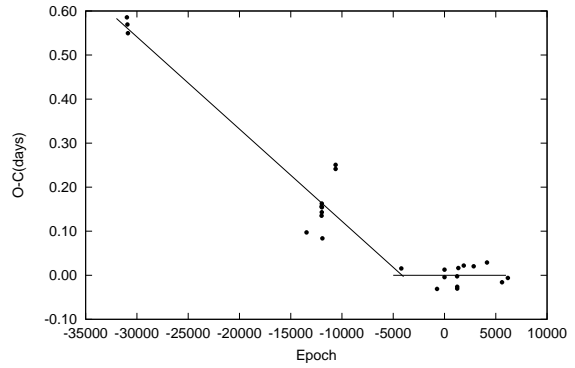


Figure 6. (O-C[2]) diagram for V2030 Oph

Table 1. Summary of this paper

Star	Type	Epoch 2400000+	Period (day)	Max.	Min.	M–m	No. of Plates
V530 Oph [1]	RRab	29843.409 ±8	0.6655105 ±36	13 ^m 5	14 ^m 6	0 ^p 20	43
V530 Oph [2]		48839.361 ±10	0.6656445 ±10				219
V824 Oph [1]	RRab	29785.544 ±3	0.4995136 ±2	14 ^m 6	16 ^m 4	0 ^p 15	42
V824 Oph [2]		44484.347 ±10	0.4995229 ±10				70
V2030 Oph [1]	RRab	29816.437 ±11	0.5197214 ±6	15 ^m 2	16 ^m 2	0 ^p 20	98
V2030 Oph [2]		45912.433 ±7	0.5204025 ±23				74

Table 2. Comparison stars and cross references

V530 Oph 227.1931 USNO 0900-10758622		V824 Oph HV 11045 USNO 0975-09721168		
Comp. No.	USNO	m*	USNO	m*
1	0900-10744874	13 ^m 2	0975-09723366	14 ^m 0
2	0900-10764580	13 ^m 8	0975-09724472	15 ^m 5
3	0900-10764415	14 ^m 9	0975-09726442	16 ^m 8

V2030 Oph S 10353 USNO 0900-10900103		
Comp. No.	USNO	m*
1	0900-10891796	14 ^m 9
2	0900-10897885	15 ^m 2
3	0900-10888277	15 ^m 6
4	0900-10895520	16 ^m 1

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

Table 3. Heliocentric times of maxima and $O - C$ values according to the elements derived in this paper; the more recent second set of elements was used in the cases with two given sets.

Star	JD (max.)	Epoch	$O - C$	Star	JD (max.)	Epoch	$O - C$	
V530 Oph (1)	25762.468 [†]	-6132	-0.031	V824 Oph (1)	29812.514	54	-0.004	
	25882.311 [†]	-5952	0.020		29816.518	62	0.004	
	29429.485 [†]	-622	0.023		29843.490	116	0.002	
	29431.450 [†]	-619	-0.008		29844.480	118	-0.007	
	29449.420 [†]	-592	-0.007		29845.480	120	-0.006	
	29453.415 [†]	-586	-0.005		V824 Oph (2)	38528.528	-11923	-0.008
	29455.430 [†]	-583	0.014			38530.533	-11919	-0.001
	29459.430 [†]	-577	0.020			38533.511	-11913	-0.020
	29469.403 [†]	-562	0.011			38553.515	-11873	0.003
	29515.361 [†]	-493	0.049			38557.512	-11865	0.004
	29541.289 [†]	-454	0.022		39618.528	-9741	0.033	
	29569.254 [†]	-412	0.035		44484.348	0	0.001	
	29785.466	-87	-0.044		45902.456	2839	-0.037	
	29787.470	-84	-0.036		48067.449	7173	0.024	
	29813.433	-45	-0.028		V2030 Oph (1)	29790.429	-50	-0.022
29843.390	0	-0.019	29816.433	0		-0.004		
29845.389	3	-0.017	29843.474	52		0.012		
V530 Oph (2)	38528.528	-15490	0.000	38910.515		17498	-0.006	
	38530.533	-15487	0.008	39672.443		18964	0.011	
	38614.404	-15361	0.008	39673.463	18966	-0.009		
	39651.438	-13803	-0.032	39684.419	18987	0.033		
	39681.420	-13758	-0.004	39685.440	18989	0.014		
	39683.420	-13755	-0.001	39686.492	18991	0.027		
	39685.460	-13752	0.042	39711.401	19039	-0.011		
	39711.401	-13713	0.023	40384.439	20334	-0.012		
	41150.468	-11551	-0.034	40385.489	20336	-0.001		
	45486.458	-5037	-0.052	V2030 Oph (2)	43717.391	-4218	0.015	
	45492.490	-5028	-0.011		45530.427	-734	-0.031	
	45522.461	-4983	0.006		45912.446	0	0.013	
	46507.630	-3503	0.021		45913.470	2	-0.004	
	46509.637	-3500	0.031		46552.526	1230	-0.002	
	46553.539	-3434	0.001	46553.539	1232	-0.030		
46609.454	-3350	0.002	46554.584	1234	-0.026			
46613.432	-3344	-0.014	46613.432	1347	0.016			
46649.390	-3290	-0.001	46885.608	1870	0.022			
46731.243	-3167	-0.022	47389.356	2838	0.020			
48839.392	0	0.031	48067.449	4141	0.029			
V824 Oph (1)	29785.550	0	0.006	48832.396	5611	-0.016		
	29786.550	2	0.007	49127.474	6178	-0.006		
	29788.540	6	-0.001					

[†] Times published by Hoffmeister (1943)

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