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THREE RR LYRAE STARS WITH VARIABLE PERIODS IN OPHIUCHUS

HÄUSSLER, K.[1]; BERTHOLD, T.[1,2]; KROLL, P.[2]

[1] Bruno-H.-Bürgel-Sternwarte, Töpelstr. 46, D-04746 Hartha, Germany

[2] Sternwarte Sonneberg, Sternwartestr. 32, D-96515 Sonneberg, Germany

email: sternwartehartha@lycos.de, tb@4pisysteme.de, pk@4pisysteme.de

These stars were reported to be RR Lyrae Variables by Boyce and Huruhata (1942) and Hoffmeister (1966); no ephemeris were published until today. 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.

Remarks:

V820 Oph
Elements valid for J.D. 2429100-2443300 and J.D. 2443700-2449500 resp.

NSV 10140
Elements valid for J.D. 2429100-2445000 and J.D. 2445000-2449500 resp. Nine times of maxima out of the second set (observed between J. D. 2445530 and J.D. 2446642) were also used to derive a meaningful period value for the first set of elements. Although 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.

NSV 10478
Due to the availability of additional older plates, a total number of 269 plates (J.D. 2425324-2449488) was used to examine this star. Elements given below are at least valid for an interval of JD 2436800-2449500. Unfortunately the distribution of the older plates is insufficient to determine a date of the period change as well as the value of the period acting in the time before the interval mentioned above.

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

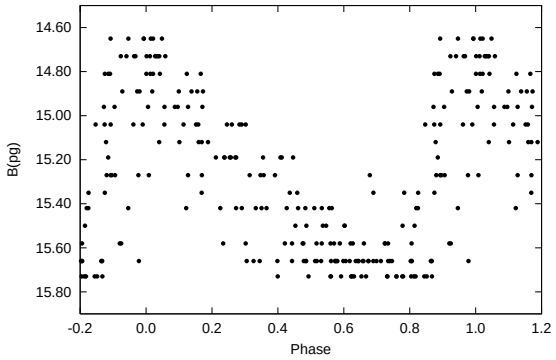

Figure 1. Composite light curve of V820 Oph

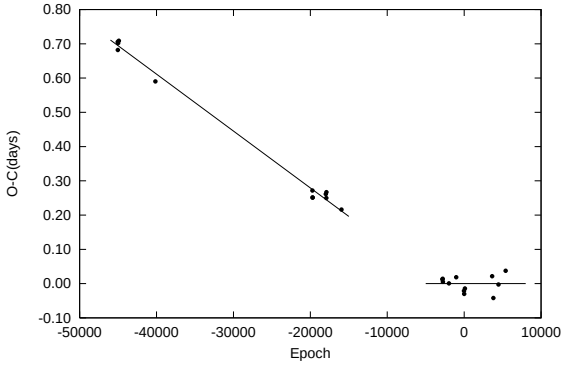

Figure 2. (O−C) diagram for V820 Oph

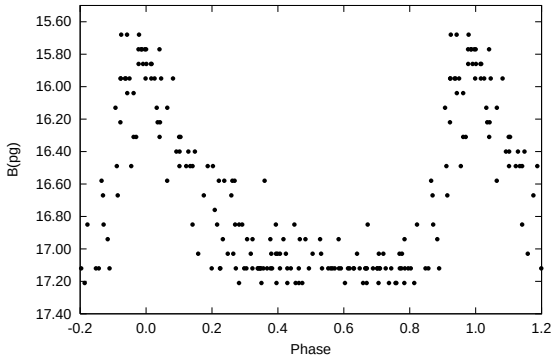

Figure 3. Composite light curve of NSV 10140

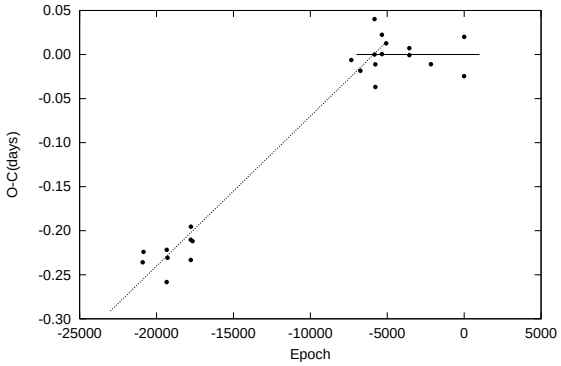

Figure 4. (O−C) diagram for NSV 10140

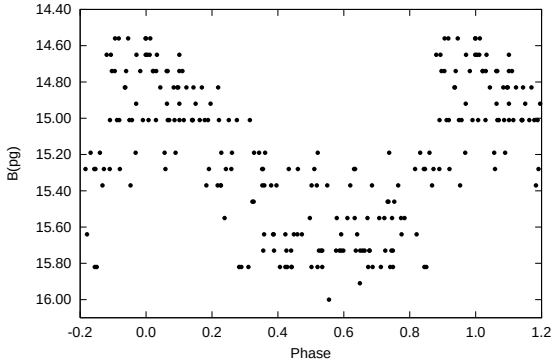

Figure 5. Light curve of NSV 10478 (J.D. 2436840 - 2449488)

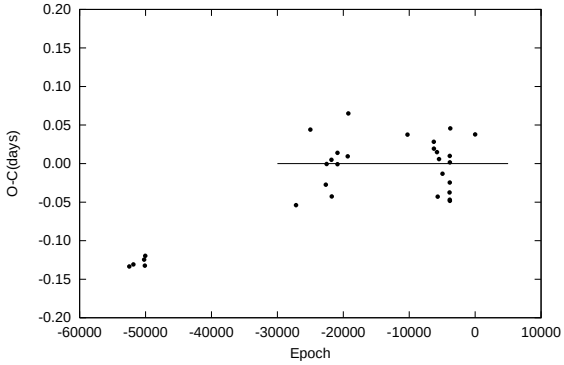

Figure 6. (O−C) diagram for NSV 10478

Table 1. Summary of this paper

Star	Type	Epoch 2400000+	Period (day)	Max.	Min.	M−m	No. of Plates
V820 Oph (1)	RRab	29785.399 ±8	0.3905520 ±4	$14^{m}.7$	$15^{m}.7$	$0^{p}.22$	105
V820 Oph (2)		47379.431 ±7	0.3905686 ±24				96
NSV 10140(1)	RRab	39678.430 ±7	0.4900743 ±8	$15^{m}.8$	$17^{m}.1$	$0^{p}.17$	98
NSV 10140(2)		49127.454 ±13	0.4900573 ±25				68
NSV 10478	RRab	49124.451 ±11	0.4520359 ±8	$14^{m}.7$	$15^{m}.7$	$0^{p}.25$	175

Table 2. Comparison stars and cross references

	V820 Oph HV 11033 USNO 0900-10444265		NSV 10140 S 9288 USNO 0900-11438187	
Comp. No.	USNO	m*	USNO	m*
1	0900-10436768	$14^{m}.6$	0900-11441724	$15^{m}.7$
2	0900-10454891	$14^{m}.9$	0900-11433031	$15^{m}.8$
3	0900-10451472	$15^{m}.0$	0900-11442001	$16^{m}.3$
4	0900-10441376	$16^{m}.1$	0900-11439742	$17^{m}.4$

	NSV 10478 S 9302 USNO 0900-12232376	
Comp. No.	USNO	m*
1	0900-12246201	$14^{m}.2$
2	0900-12233841	$14^{m}.8$
3	0900-12226131	$15^{m}.4$

* 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.

Star	JD (max.*)	Epoch	$O-C$	Star	JD (max.*)	Epoch	$O-C$
V820 Oph (I)	29785.410	0	0.011	NSV 10140 (II)	46506.628	−5348	0.001
	29788.511	8	−0.013		46507.630	−5346	0.023
	29808.450	59	0.008		46642.386	−5071	0.013
	29844.389	151	0.016		47380.399	−3565	0.000
	31696.347	4893	−0.023		47381.387	−3563	0.008
	39671.44	25313	−0.003		48067.449	−2163	−0.011
	39678.450	25331	−0.023		49124.489	−6	−0.024
	39685.480	25349	−0.023		49127.474	0	0.020
	40354.534	27062	0.016	NSV10478	25406.445	−52469	−0.133
	40381.472	27131	0.006		25687.614	−51847	−0.131
	40383.442	27136	0.023		26427.603	−50210	−0.125
	41150.468	29100	0.005		26475.511	−50104	−0.132
V820 Oph (II)	46271.400	−2837	0.012		26504.454	−50040	−0.120
	46289.368	−2791	0.014		36840.321	−27175	−0.054
	46298.342	−2768	0.005		37820.433	−25007	0.044
	46608.449	−1974	0.001		38883.550	−22655	−0.027
	46974.430	−1037	0.019		38936.465	−22538	−0.001
	47368.474	−28	−0.021		39270.525	−21799	0.005
	47379.401	0	−0.030		39289.463	−21757	−0.043
	47415.349	92	−0.014		39681.420	−20890	−0.001
	48801.513	3641	0.022		39685.503	−20881	0.014
	48862.378	3797	−0.042		40383.442	−19337	0.009
	49124.489	4468	−0.003		40426.441	−19242	0.065
	49488.539	5400	0.037		44484.340	−10265	0.038
NSV 10140 (I)	38883.550	−1622	0.020		46288.406	−6274	0.028
	38910.515	−1567	0.031		46298.342	−6252	0.019
	39648.507	−61	−0.029		46507.630	−5789	0.015
	39651.484	−55	0.008		46554.584	−5685	−0.043
	39678.428	0	−0.002		46646.396	−5482	0.006
	40417.432	1508	−0.030		46884.600	−4955	−0.013
	40418.435	1510	−0.007		47366.446	−3889	−0.037
	40419.430	1512	0.007		47381.376	−3856	−0.025
	40473.320	1622	−0.011		47385.422	−3847	−0.047
NSV 10140 (II)	45530.427	−7340	−0.006		47386.383	−3845	0.010
	45822.489	−6744	−0.018		47390.393	−3836	−0.048
	46270.460	−5830	0.041		47391.347	−3834	0.002
	46271.400	−5828	0.000		47415.349	−3781	0.046
	46296.356	−5777	−0.036		49124.489	0	0.038
	46298.342	−5773	−0.011				

* Mid-exposure times of plates with brightest observations

References:

Hoffmeister, C., 1966, *Astron. Nachr.*, **289**, 139

Boyce, Hughes, E., Huruhata, M., 1942, *Harvard Annals*, **109**, No. 4, 19

ERRATUM FOR IBVS 5607

The correct identifier for NSV 10478 is USNO 0900-12232367.

The Editors