New Light Elements for the RR Lyr Type Variable Star DV Mon

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Abstract From analysis of the times of maxima published in the literature together with new ones obtained by the author by means of a CCD camera, it has been possible to derive new light elements for the RR Lyr type variable star DV Mon. It seems clear that recent CCD data do not fit previous measurements, showing, therefore, a change in the period of variation before JD 2448900; the lack of data prevents us from better describing the shape of the O–C diagram.

1. Discussion

DV Mon (= AN 83.1936 = GSC 5378.2034; R.A. $06^{h}\,45^{m}\,19\overset{s}{.}36$, Dec. $-08°\,50'\,20\overset{''}{.}20$, Equinox 2000) was first discovered as a short period variable star by Hoffmeister (1936). Further investigation was carried out by Anhert (1949) who, using the plate archive of the Sonneberg Astronomical Observatory (Germany), was able to detect the type of variation (RR), 25 times of maxima, and first light elements as follows:

$$\text{Max} = \text{JD } 2425246.500 + 0.413394 \text{ day.} \qquad (1)$$

On the basis of these results the star was included in the *General Catalogue of Variable Stars* (GCVS) (Kholopov *et al.* 1985) with the official designation "DV Mon." More measurements on this variable have been published by Schmidt (1996) and by Layden (1997) during their surveys on galactic RR Lyr type variable stars.

2. Observations

DV Mon has been observed since 2000 by means of a CCD camera using a TI245C chip, mounted on a 0.2m Newtonian telescope (F/5) permanently installed in a small private observatory in Busto Arsizio, northern Italy. The photometric calibration of the row CCD images has been made according to the standard method as specified in the following formula:

REDUCED = [(ROW) – (BIAS) – (MASTER DARK)] / (MASTER FLAT)

167 unfiltered measures obtained on DV Mon from JD 2451574 to JD 2452677 have been analyzed using the program Prism by French astronomers Cavadore and Gaillard.

A sub-routine running under Prism has been developed by the author to perform automatic photometric analysis (PSF) of an object from a set of images.

As output, it will show a table in which, for each image, are listed the average time of the exposure (day, month, year, hour, minute, second, and G.J.D.), the measured flux of the object (V), of the comparison star (C), and of the check stars (K1) and (K2), and the differential magnitude and error of the target star relative to the comparison star. Data coming from photometric analysis of the images are, subsequently, imported into a worksheet where the measurement times are updated with the heliocentric correction.

Tycho-2 5378.1590.1 (mag. 10.95V, B–V 0.01) was chosen as comparison star, while USNO A2.0 0750.02713622 (mag. 12.0 R) and USNO A2.0 0750.02712611 (mag. 11.9 R) served as check stars.

From the measurements it has been possible to build the light curve shown in Figure 1, and to determine three new times of maxima listed, together with the other timings available from the literature, in Table 1. A least squares linear regression of all the timings published gives the following ephemeris:

$$\begin{array}{rl} \text{Max} = \text{JD } 2425246.4919 + 0.4133965\ \text{E}. & (2) \\ \pm\ \ 0.0074 \quad\ 0.0000003 & \end{array}$$

The resulting O–C diagram shows that the CCD times of maxima measured since JD 2448900 are not well fitted by the above equation probably due to a physical variation of the period. Unfortunately the lack of data in the O–C diagram prevents us from learning more about the change of period of DV Mon. A new least squares linear regression, taking into consideration only timings after JD 2448900, gives the following new ephemeris:

$$\begin{array}{rl} \text{Max} = \text{JD } 2448972.6097 + 0.41338624\ \text{E}. & (3) \\ \pm\ \ 0.0034 \quad\ 0.00000060 & \end{array}$$

The O–C diagram (Figure 2), drawn using equation 3, indicates that the supposed period change occurred between JD 2435000 and JD 2440000.

3. Acknowledgements

This research has made use of the SIMBAD database, operated at Centre de Données Astronomiques de Strasbourg, and of the GEOS RR LYR database (http://webast.ast.obs-mip.fr/people/leborgne/dbRR) maintained by Dr. LeBorgne.

References

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Layden, A. C., 1997, *Publ. Astron. Soc. Pacific*, **109**, 524.
Schmidt, E. G., and Seth, A. 1996, *Astron. J.*, **112**, 2769.

Table 1. Times of maxima of DV Mon available in the literature based on light elements explained in the text.

HJD	*Err*	*B*	*Observer*	*Publ.*	*E(1)*	*O–C (1)*	*E(2)*	*O–C (2)*	*E(3)*	*O–C (3)*
2425246.47		Ph	Ahnert	VSS 1, 3	0	–0.0300	0	–0.0219	–57394	–0.25
2425534.64		Ph	Ahnert	VSS 1, 3	697	0.0044	697	0.0108	–56697	–0.21
2425650.38		Ph	Ahnert	VSS 1, 3	977	–0.0059	977	–0.0002	–56417	–0.22
2425984.46		Ph	Ahnert	VSS 1, 3	1785	0.0517	1785	0.0554	–55609	–0.15
2426772.35		Ph	Ahnert	VSS 1, 3	3691	0.0127	3691	0.0117	–53703	–0.18
2427130.31		Ph	Ahnert	VSS 1, 3	4557	–0.0265	4557	–0.0297	–52837	–0.21
2427343.63		Ph	Ahnert	VSS 1, 3	5073	–0.0178	5073	–0.0223	–52321	–0.20
2427396.58		Ph	Ahnert	VSS 1, 3	5201	0.0178	5201	0.0130	–52193	–0.16
2427420.54		Ph	Ahnert	VSS 1, 3	5259	0.0010	5259	–0.0040	–52135	–0.18
2427459.46		Ph	Ahnert	VSS 1, 3	5353	0.0619	5353	0.0567	–52041	–0.12
2427505.33		Ph	Ahnert	VSS 1, 3	5464	0.0452	5464	0.0397	–51930	–0.13
2427718.64		Ph	Ahnert	VSS 1, 3	5980	0.0439	5980	0.0371	–51414	–0.13
2427781.46		Ph	Ahnert	VSS 1, 3	6132	0.0280	6132	0.0209	–51262	–0.14
2427884.32		Ph	Ahnert	VSS 1, 3	6381	–0.0471	6381	–0.0549	–51013	–0.22
2429633.45		Ph	Ahnert	VSS 1, 3	10612	0.0129	10612	–0.0054	–46782	–0.12
2429634.25		Ph	Ahnert	VSS 1, 3	10614	–0.0139	10614	–0.0322	–46780	–0.15
2429635.50		Ph	Ahnert	VSS 1, 3	10617	–0.0041	10617	–0.0224	–46777	–0.14
2429696.32		Ph	Ahnert	VSS 1, 3	10764	0.0470	10764	0.0283	–46630	–0.09
2430346.56		Ph	Ahnert	VSS 1, 3	12337	0.0182	12337	–0.0043	–45057	–0.11
2430731.44		Ph	Ahnert	VSS 1, 3	13268	0.0284	13268	0.0035	–44126	–0.09
2430735.57		Ph	Ahnert	VSS 1, 3	13278	0.0245	13278	–0.0004	–44116	–0.09
2430784.30		Ph	Ahnert	VSS 1, 3	13396	–0.0260	13396	–0.0512	–43998	–0.14
2430788.44		Ph	Ahnert	VSS 1, 3	13406	–0.0200	13406	–0.0452	–43988	–0.14

(Table 1 continued on following page)

Table 1. Times of maxima of DV Mon available in the literature based on light elements explained in the text, continued.

HJD	*Err*	*B*	*Observer*	*Publ.*	*E(1)*	*O–C (1)*	*E(2)*	*O–C (2)*	*E(3)*	*O–C (3)*
2430791.35		Ph	Ahnert	VSS 1, 3	13413	–0.0037	13413	–0.0289	–43981	–0.12
2431031.58		Ph	Ahnert	VSS 1, 3	13994	0.0444	13994	0.0177	–43400	–0.07
2448972.6120		CCD	Layden	PASP 109	57393	0.1902	57393	0.0556	0	0.0023
2450025.9140		CCD	Schmidt	AJ 112	59941	0.1642	59941	0.0234	2548	–0.0038
2451574.4641	0.0034	CCD	Martignoni	This Work	63687	0.1404	63687	–0.0098	6294	0.0014
2451956.4280	0.0024	CCD	Martignoni	This Work	64611	0.1283	64611	–0.0242	7218	–0.0036
2451963.4629	0.0034	CCD	Martignoni	This Work	64628	0.1355	64628	–0.0170	7235	0.0038

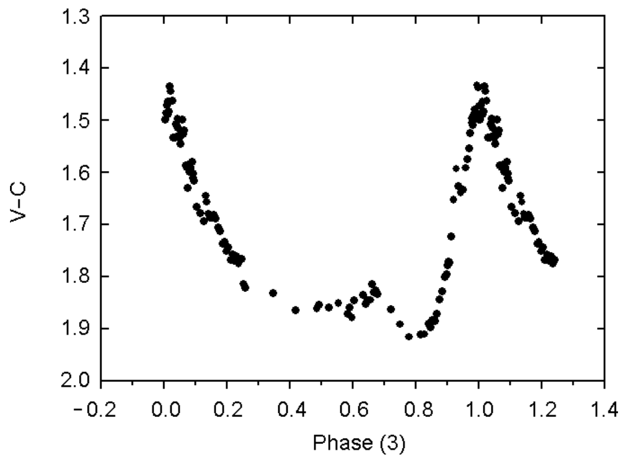

Figure 1. Light curve of DV Mon obtained with a TI245C CCD Camera.

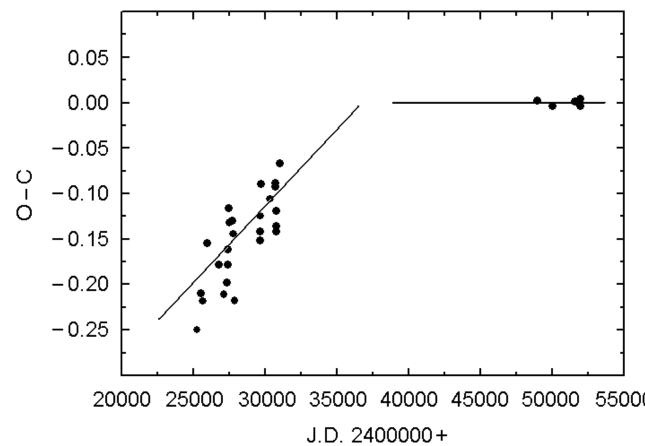

Figure 2. O–C diagram of the published times of maxima of DV Mon.