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V406 LYRAE: NEW EPHEMERIS AND LIGHTCURVE

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In this paper we report on our photographic and CCD photometry on the β Lyr type variable V406 Lyr.

V406 Lyr = SVS 1015 = CSV 4208 was announced as a short period variable by Parenago (1946) with a brightness range between $12\overset{m}{.}4$ and $13\overset{m}{.}3$. Meinunger (1970) investigated this variable on plates of the Sonneberg Sky Survey. He classified the star as eclipsing, gave 23 minima, calculated from them a first ephemeris as

$$\text{Min I} = HJD\,2438525.500 + 1\overset{d}{.}51130 \times \text{E}$$

and published a first photographic light curve. The range in this lightcurve is roughly between $12\overset{m}{.}5$ and $13\overset{m}{.}0$. The variable got its definitive name in the 58^{th} name-list of variable stars (Kukarkin et al. 1972). With the data above V406 Lyr was included in the fourth edition of the GCVS (Kholopov et al. 1985).

For more than twenty years the variable had remained obviously unobserved when the BAV published a photographic minimum timing (Moschner, Kleikamp 1990). Since that time we have investigated V406 Lyr photographically and photoelectrically. The photographic observations were made with a 32 cm RC telescope and the exposures were evaluated with a fixed diaphragm photometer. The CCD observations were performed with an SBIG ST6 camera without filters attached to a 20 cm SC telescope (F.A.) or to the 32 cm RC telescope (W.M.). Altogether three new photographic and nine CCD minima could be collected. All minima times were calculated with the Kwee–van Woerden (1956) method. In the instrumental system of the CCD observations the depth of the primary and secondary minima were found to be $0\overset{m}{.}88$ and about $0\overset{m}{.}56$, respectively. In compiling the lightcurve (Figure 1) from our data it became evident that the period published in the GCVS was a spurious one with the relation

$$\frac{1}{\text{P}} - \frac{1}{\text{P}_{\text{GCVS}}} = \frac{1}{2} \quad .$$

Using all published minima found in the 'BAV Database of Minima of Eclipsing Binaries' together with our new observations, a weighted least squares fit yields the following linear ephemeris:

$$\begin{array}{cc} \text{Min I} = \text{HJD}\,2449250.4582 + 0\overset{d}{.}86078384 \times \text{E} \\ \qquad\qquad \pm 4 \qquad\qquad\quad \pm 9 \end{array} \qquad (1)$$

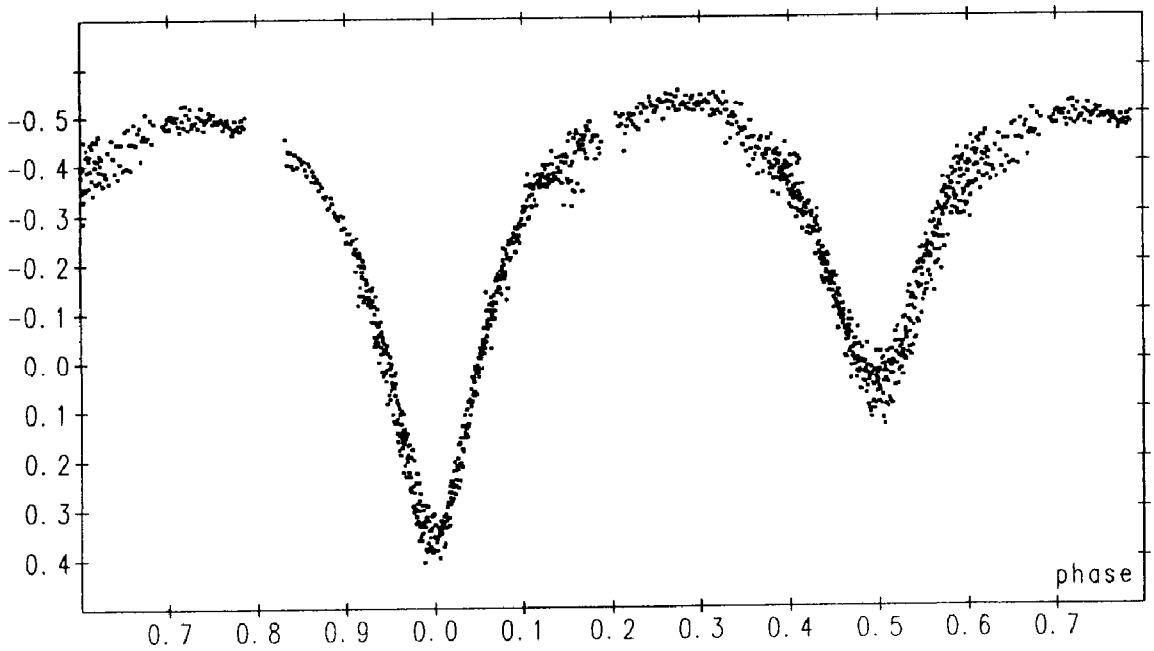

Figure 1: Differential lightcurve of V406 Lyr
computed with respect to the new ephemeris (1).

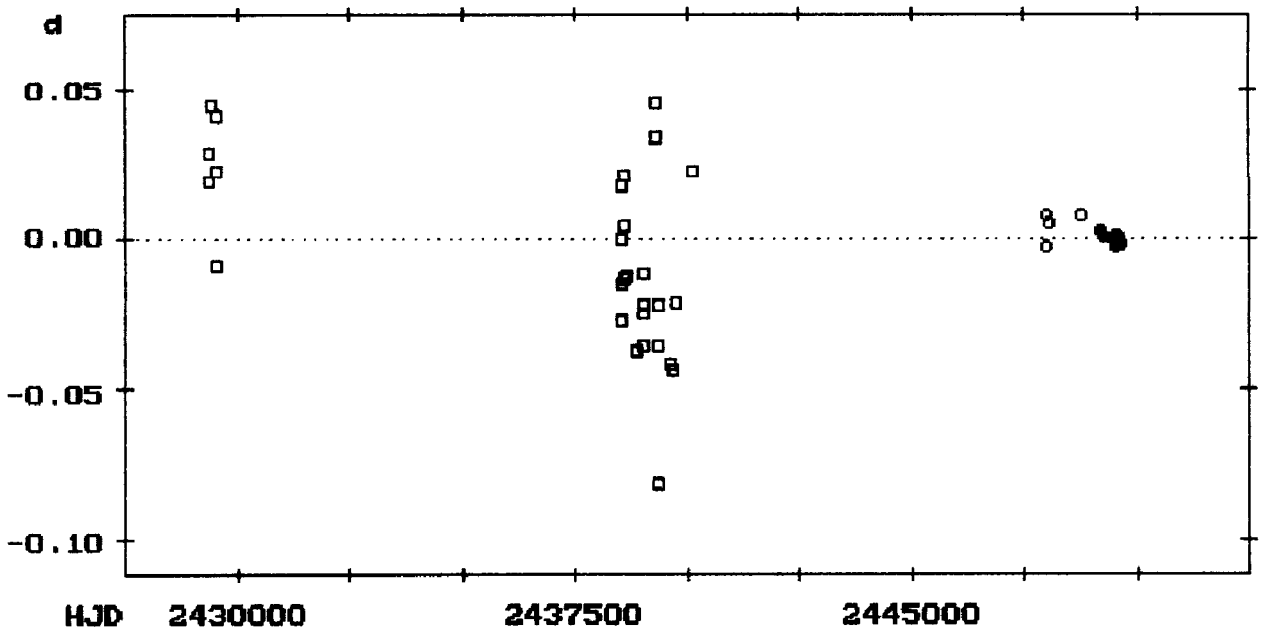

Figure 2: O–C diagram for V406 Lyr computed with respect to
the new ephemeris (1) using all available minimum timings.
• represents photoelectric, ○ photographic
series and □ photographic plate minima.

Table 1. Observed times of minima for V406 Lyr, epochs and residuals computed with respect to the ephemeris (1) derived in this paper.

N	JD hel. 2400000+	W	T*	Epoch	(O–C)	Lit	N	JD hel. 2400000+	W	T*	Epoch	(O–C)	Lit
1	29321.61	2	P	−23152.0	+0.02	[1]	22	39289.502	2	P	−11572.0	+0.034	[2]
2	29365.52	2	P	−23101.0	+0.03	[1]	23	39348.395	2	P	−11504.5	–0.036	[2]
3	29403.41	2	P	−23057.0	+0.04	[1]	24	39351.422	2	P	−11500.0	–0.022	[2]
4	29495.46	2	P	−22950.0	–0.01	[1]	25	39376.325	2	P	−11471.0	–0.082	[2]
5	29515.29	2	P	−22927.0	+0.02	[1]	26	39619.536	2	P	−11189.5	–0.042	[2]
6	29527.36	2	P	−22913.0	+0.04	[1]	27	39709.486	2	P	−11084.0	–0.044	[2]
7	38525.540	2	P	−12460.5	+0.018	[2]	28	39760.295	2	P	−11025.0	–0.021	[2]
8	38528.520	2	P	−12456.0	–0.015	[2]	29	40150.274	2	P	−10572.0	+0.023	[2]
9	38550.470	2	P	−12431.5	–0.015	[2]	30	47969.609	10	F:	−1488.0	–0.003	[3]
10	38553.470	2	P	−12427.0	–0.027	[2]	31	48013.520	20	F	−1437.0	+0.008	[4]
11	38556.510	2	P	−12424.5	–0.000	[2]	32	48016.530	20	F	−1434.5	+0.005	[4]
12	38559.510	2	P	−12420.0	–0.013	[2]	33	48746.477	20	F	−586.5	+0.008	[4]
13	38584.490	2	P	−12391.0	+0.004	[2]	34	49216.4598	60	E	−40.5	+0.0026	[5]
14	38587.520	2	P	−12388.5	+0.022	[2]	35	49250.4595	60	E	0.0	+0.0013	[5]
15	38640.424	2	P	−12326.0	–0.013	[2]	36	49485.4519	60	E	273.0	–0.0003	[6]
16	38883.570	2	P	−12044.5	–0.038	[2]	37	49525.4758	60	E	319.5	–0.0028	[5]
17	39021.309	2	P	−11884.5	–0.024	[2]	38	49547.4292	60	E	345.0	+0.0006	[5]
18	39024.310	2	P	−11880.0	–0.036	[2]	39	49568.5188	60	E	369.5	+0.0010	[5]
19	39027.348	2	P	−11877.5	–0.011	[2]	40	49580.5682	60	E	383.5	–0.0006	[5]
20	39052.300	2	P	−11848.5	–0.022	[2]	41	49597.3529	60	E	403.0	–0.0012	[5]
21	39286.501	2	P	−11576.5	+0.046	[2]	42	49625.3281	60	E	435.5	–0.0015	[5]

[1]: Parenago (1946), [2]: Meinunger (1970), [3]: Moschner, Kleikamp (1990), [4]: Moschner, Kleikamp: this paper, [5]: Agerer: this paper, [6]: Moschner: this paper.
*) P denotes pg plate min., E CCD min. and F photographic series. Those marked with ':' got reduced weight.

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