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NSV 4539 IS AN ECLIPSING BINARY

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NSV 4539 (= GSC 238.0737 = PPM 155983 = SAO 117785 = BD +05°2200 = HD 082908 (A2) = CSV 101063 = 349.1934 = Pr 3303 = AG +04°1322) was announced as a short period variable by Hoffmeister (1934) with a brightness range between $9^{\rm m}$ and $10^{\rm m}$ and a spectral type A2. Sandig (1947) found NSV 4539 (= Pr 3303) to be constant at $9\overset{\rm m}{.}5$ on 35 photographic plates. According to Tsesevich (1952) NSV 4539 is probably not periodic and in no case short periodic.

Because of their proximity, NSV 4539 was included in a photometric investigation of AV Hya. Every third day, NSV 4539 showed an ascending branch from a minimum. Our photoelectric measurements on 20 nights in 1995 and 1996 excluded that the period is an integer fraction of these 3 days.

The photoelectric observations were made at the private observatory of one of us (F.A.) with an automatic photoelectric telescope. The photometer was equipped with an uncooled EMI 9781A tube and Schott filters for B and V. The moment of minimum light of completely observed minima was calculated using the method of Kwee and van Woerden (1956), for the others, the minima times were derived from the descending or ascending branches.

SAO 117771 (F8) served as comparison star and SAO 117803 (F5) was used to check its constancy. The amplitude of the primary minimum is about $0\overset{\rm m}{.}40$. In the secondary minimum the amplitude does not exceed $0\overset{\rm m}{.}05$ in V and is even less in B. The duration between first and last contact is about 8.5 hours; a total eclipse could not be detected. The individual measurements are sent by e-mail on request.

The construction of a complete lightcurve was found to be extremely difficult from one location, for the difference between the period and three whole days sums up to almost a whole day after a year. The photoelectric lightcurve is therefore incomplete. To get information about period changes in the past and of those parts of the lightcurve which could not be observed, one of us (T.B.) investigated the star on 635 plates of the Sonneberg Sky Survey covering the interval from 1956 until 1995. Photographic magnitudes were obtained with a photometer and refer to Harvard-Groningen SA 100 (see Figure 1). The following comparison stars were used:

GSC 238_1193	8.48 m_{pg}
GSC 238_1621	9.03 m_{pg}
GSC 238_1847	9.49 m_{pg}

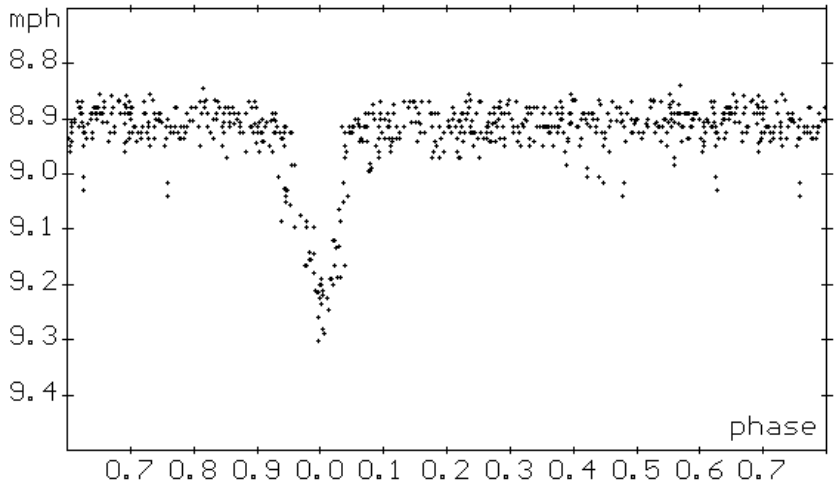

Figure 1. Differential photographic light curve of NSV 4539, drawn with the ephemeris (2) derived in this paper

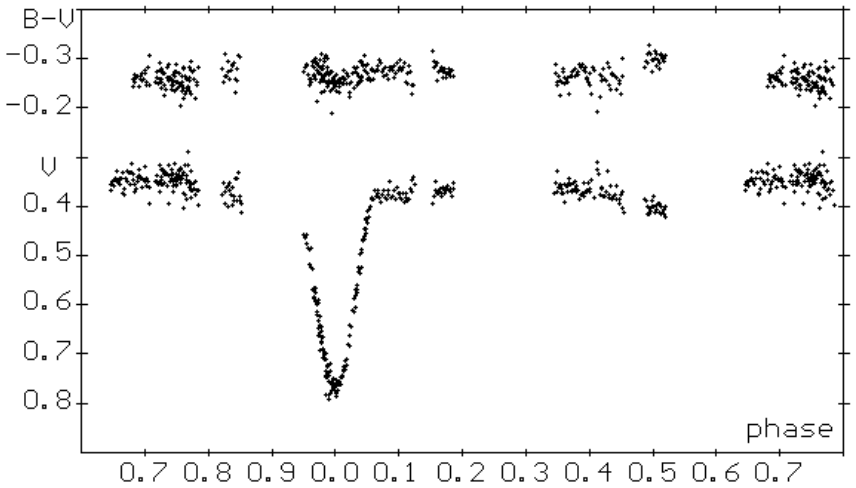

Figure 2: Differential photoelectric light curve in V and B – V of NSV 4539, drawn with the ephemeris (2) derived in this paper

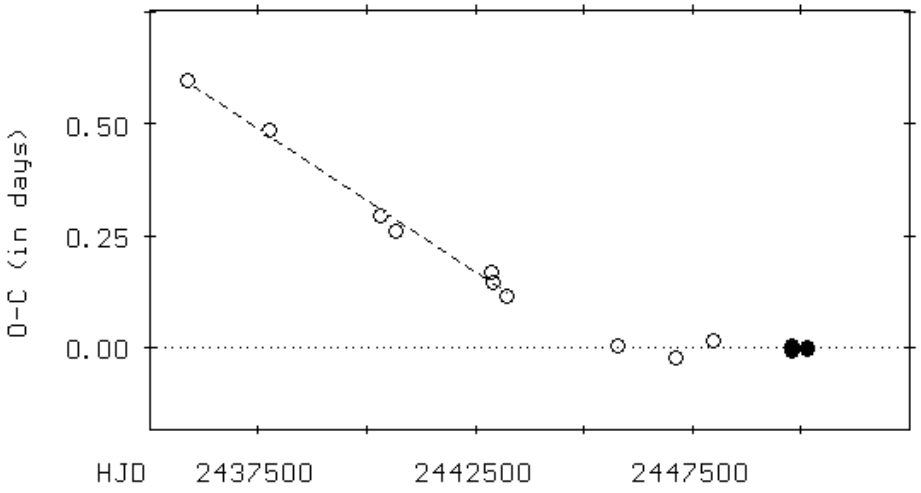

Figure 3: O–C diagram of NSV 4539, drawn with the ephemeris (2) derived in this paper

Obviously the period has not been constant in the examined interval. Weighted least squares fits provided the following set of linear ephemeris:

From JD 2435848 to JD 2444702:

$$\begin{array}{rcl} \text{Min I} = \text{HJD}\,2437752.353 & + & 3^{\text{d}}.0093968 \times \text{E} \\ \pm 26 & & \pm 78 \end{array} \qquad (1)$$

From JD 2444984 to JD 2450151:

$$\begin{array}{rcl} \text{Min I} = \text{HJD}\,2450151.3916 & + & 3^{\text{d}}.0095905 \times \text{E} \\ \pm 6 & & \pm 25 \end{array} \qquad (2)$$

Until now, it has been not possible to decide whether the period changes occur in an erratic, periodic or secular way. Further observations are needed.

Table 1. Times of minima for NSV 4539, epochs and residuals computed with respect to the ephemeris (2)

N	JD hel.	W	T*	Epoch	O−C	Observer
1	2435874.492	1	P	−4744.0	+0.598	Berthold
2	37752.366	1	P	−4120.0	+0.487	”
3	40325.375	1	P	−3265.0	+0.296	”
4	40656.396	1	P	−3155.0	+0.262	”
5	42871.362	1	P	−2419.0	+0.170	”
6	42889.396	1	P	−2413.0	+0.146	”
7	43217.411	1	P	−2304.0	+0.116	”
8	45763.413	1	P	−1458.0	+0.004	”
9	47099.643	1	P	−1014.0	−0.024	”
10	47969.456	1	P	−725.0	+0.018	”
11	49778.203	10	V	−124.0	+0.001	Agerer
12	49778.205	10	B	−124.0	+0.003	”
13	49784.221	10	V	−122.0	−0.001	”
14	49784.226	10	B	−122.0	+0.004	”
15	49787.233	10	B	−121.0	+0.002	”
16	49787.234	10	V	−121.0	+0.003	”
17	49793.242	5	V:	−119.0	−0.008	”
18	49793.243	5	B:	−119.0	−0.007	”
19	50142.360	5	V:	−3.0	−0.003	”
20	50151.3886	10	V	0.0	−0.0030	”
21	50151.3921	10	B	0.0	+0.0005	”

* P denotes photographic minima, B and V are photoelectrically observed, those marked ‘:’ got reduced weight (W).

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