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NSV 5904: A NEW W UMa ECLIPSING BINARY

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NSV 5904 (GSC 3021 2642; $12^{\rm h}43^{\rm m}37\overset{\rm s}{.}22$, $+38^\circ44'16\overset{''}{.}4$; 2000.0) was first suspected to be a variable ranging from magnitude 11.2 to 12.0 (p) by Weber (1963). Since 1996, it has been visually monitored by two GEOS observers (Vandenbroere and Verrot) whose estimates confirmed the variability of the star showing an apparent period of $0\overset{\rm d}{.}16345$ (Vandenbroere 1999).

Photoelectric measurements were performed at the Jungfraujoch station on the basis of the collaboration between GEOS and Geneva Observatory. Nine BV points were obtained on two nights in December 1998 ("all-sky" photometry, see Table 1). The very small amplitude of the $B-V$ colour index suggested the eclipsing nature of NSV 5904. The orbital period calculated from 20 visual minima was 0.3268885 ± 0.00006 d.

Table 1: The V and $(B-V)_G$ photoelectric measurements of NSV 5904

HJD	V	$(B-V)_G$	Phase
2451170.5986	11.093	+0.020	0.582
2451170.6118	11.005	+0.010	0.622
2451170.6570	10.964	−0.015	0.761
2451170.6875	11.084	+0.002	0.854
2451172.6294	10.977	−0.011	0.794
2451172.6530	11.091	−0.000	0.867
2451172.6703	11.261	+0.015	0.920
2451172.6912	11.463	+0.038	0.983
2451172.7057	11.407	+0.018	0.028

After that, Martignoni made 228 CCD measurements of NSV 5904 in order to obtain its photometric light curve (see Fig. 1). He used an unfiltered CCD Seti 245C 378×242 attached to a 215-mm $f/5$ reflector at his private station in Busto Arsizio, Italy, and he chose GSC 3021 2613 ($11\overset{\rm m}{.}4$) and GSC 3021 0451 ($12\overset{\rm m}{.}9$) as comparison stars. The CCD light curve allowed him to discriminate between the primary and secondary minima. A more accurate orbital period was determined by means of 6 CCD and 16 new visual times of minima together with the 20 times already published (Vandenbroere 1999). The result of the linear regression, giving a double weight to the CCD times, is the following:

$$\begin{array}{c} \text{Min I} = \text{HJD } 2450571.219 + 0\overset{\rm d}{.}326890 \times E. \\ \qquad\qquad\quad \pm 0.003 \quad \pm 0.000002 \end{array}$$

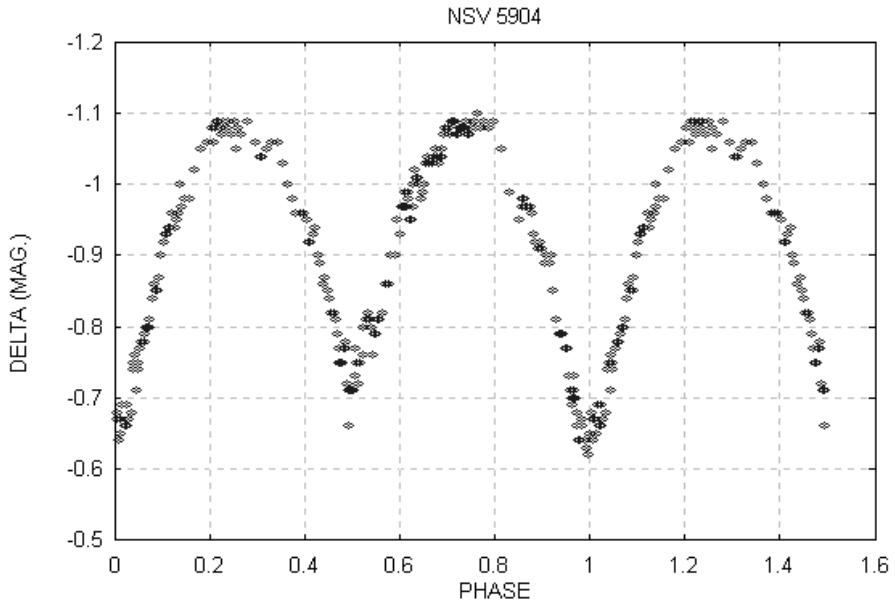

Figure 1. CCD unfiltered light curve of NSV 5904

The CCD minima can be found in Table 2. Visual timings are regularly published in the BBSAG bulletins or can be obtained from the authors. Phases and $O-C$'s in Tables 1 and 2 are calculated in respect with the above ephemeris.

Table 2: CCD minima of NSV 5904

HJD	E	$O-C$
2451679.3732	3390	−0.0038
2451687.3840	3414.5	−0.0018
2451688.3639	3417.5	−0.0026
2451694.4142	3436	+0.0002
2451696.3730	3442	−0.0023
2451711.4138	3488	+0.0015

Together with the B and V photoelectric measurements, we can deduce from the CCD light curve that NSV 5904 varies from magnitude 10.96 to 11.47 (V-light) at primary minimum, with a secondary minimum going to magnitude 11.40. The $(B-V)_G$ index of NSV 5904 varies very little around 0.01 which corresponds to a $B-V$ index of 0.78 after transformation to the UBV system and assuming luminosity class V.

An attempt to model the system was made using the Binary Maker software (Bradstreet 1993), but systematic deviations between observational points and fitting curve were always found. A more sophisticated method combined with multiwavelength observations should allow a better description; at this purpose, the original measurements are available from the IBVS website as 5021-t3.txt.

References:

Bradstreet, D.H., 1993, *Binary Maker 2.0 User Manual*, Contact Software, Norristown, PA 19401-5505, USA

Vandenbroere, J., 1999, *NC GEOS*, No. 894

Weber, R., 1963, *IBVS*, No. 21