Investigation of Five Suspected Variables

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Abstract Using a CCD Camera with a Kodak 401E/L chip and a Meade LX200 Schmidt Cassegrain telescope, we confirmed variability and determined preliminary light elements of three stars listed in the *NSV Catalogue*: NSV 11924, NSV 12971, and NSV 12978. The first two are pulsating variables of the RR Lyr type. The third one is an eclipsing binary of the EW sub-class. For other two stars (NSV 10998 and NSV 12965) no variability was detected.

1. Introduction

During the summer of 2003, at the author's observatory situated in Busto Arsizio, northern Italy, the author observed 5 suspected variable stars in the *New Catalogue of Suspected Variable Stars* (NSV; Kholopov, *et al.* 1982) for which meagre information is available in the literature. For this survey the author used a 203mm Schmidt-Cassegrain (Meade LX200) and a CCD with a Kodak 401E/L chip manufactured by the Italian company D.T.A. of Pisa.

As the main target of the present project was to discover variability of a group of suspected variables, the images were obtained without photometric filters. For this reason, the y-axis in the light curves has to be read as "instrumental magnitude."

2. NSV 10998

NSV 10998 (=BV 113=TYC 03109.00380.1; R.A. $18^h 31^m 37\overset{s}{.}15$, Dec. +40° 51' 53."7, Equinox = 2000.0) was discovered by Geyer (1955) as a suspected variable star of long period during a photographic survey carried out at the Bamberg Observatory in Germany. Filatov (1960) reported it as a short period Cepheid on the basis of his visual observations. With these parameters the star was included in the first edition of the *NSV Catalogue*. The *Tycho Catalogue* (Perryman *et al.* 1997) gives a mean magnitude of 11.59*V* for this star.

A total of 46 CCD measurements taken between JD 2452831 and JD 2452919 do not show any variation, so the suspected RR type nature is not confirmed. GSC 03109.00434 (12.97v) has been used as a comparison star and GSC 03109.00047 (14.91v) as a check.

3. NSV 11924

NSV 11924 (= S9661 = GSC 03547.00221; R.A. $19^h 19^m 57\overset{s}{.}98$, Dec. +46° 53' 21."3, Equinox = 2000.0) was discovered as a short period variable star of the RR type by

Hoffmeister (1967), who also published one certain time of maximum. On the basis of these results the star was included in the *NSV Catalogue*.

191 CCD measurements collected between JD 2452893 and JD 2452922 enabled us to confirm NSV 11924 as a variable of RR Lyr type. The light curve is shown in Figure 1. We obtained two new times of maximum light which, with data by Hoffmeister (Table 1), allow us to calculate the following ephemeris:

$$\text{Max} = \text{JD } \underset{\pm 0.0001}{2452900.4250} + \underset{\pm 0.00000010}{0.54823035}\,E. \tag{1}$$

GSC 03547.00902 (12.35v) has been used as comparison star and GSC 03547.00886 (14.01v) as a check. The amplitude of variation is about 0.6 magnitude.

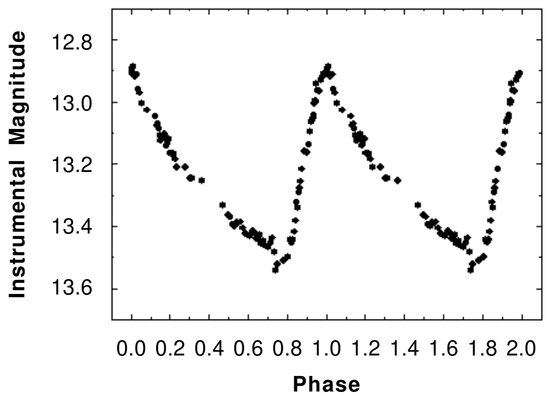

Figure 1. CCD light curve of NSV 11924.

Table 1. Times of maxima of NSV 11924.

HJD	*E (1)*	*O–C (1)*	*Observer*	*Publication*
2438651.37	–25991.0	0.0000	Hoffmeister	AN 289.205
2452900.4251	0.0	0.0001	Martignoni	This work
2452922.3541	40.0	–0.0001	Martignoni	This work

Searching for more recent bibliographic references on this object using the Strasbourg Observatory's SIMBAD database, it was found that the star ROTSE1 J191957.87+465320.6 had very similar parameters in the same location of the sky. This led us to suppose that it is the same object as NSV 11924.

4. NSV 12965

NSV 12965 (=SVS 802 = TYC 03937.01506.1; R.A. $20^{h}14^{m}58\overset{s}{.}59$, Dec. +53° 11′ $36\overset{\prime\prime}{.}2$, Equinox = 2000.0) was suspected to be variable by Parenago (1938) and confirmed visually by Shakhovskoi (1957) who also found the RR Lyr type.

A total number of 32 CCD measurements taken between JD 2452852 and JD 2452929 does not show any kind of variation. TYC 03937.01249.1 (11.79*V*) has been used as comparison star and GSC 03937.01213 (13.24v) as a check.

5. NSV 12971

NSV 12971 (=S 8373=USNO A2.0 1050.17091287; R.A. $20^h 16^m 53\overset{s}{.}94$, Dec. +16° 55' 26".0, Equinox = 2000.0) was cataloged as a suspected variable star of short period by Hoffmeister (1964).

NSV 12971 was observed with the CCD camera, with 139 measures being made between JD 2452855 and JD 2452922. GSC 01635.00009 (12.34v) has been used as comparison star and USNO A2.0 1050.17090833 as a check. On the basis of these measurements we are able to confirm the RR Lyr type variation of this star. Unfortunately, as NSV 12971 is a very faint star on our images, the resulting light curve (Figure 2) shows considerable noise. For this reason the following ephemeris should be read as preliminary:

$$\text{Max} = \text{JD } 2452912.4077 + 0.2995\ \text{E}. \tag{2}$$

The resulting amplitude of variation is about 0.6 magnitude.

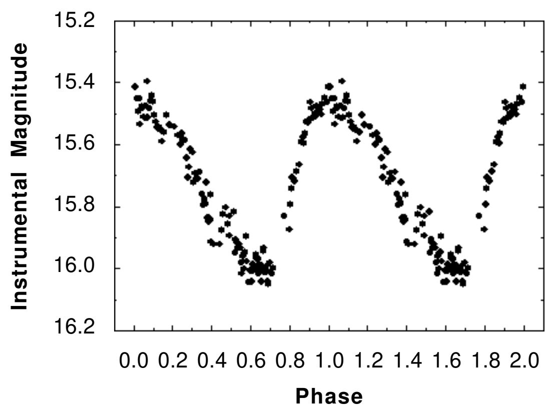

Figure 2. CCD light curve of NSV 12971.

6. NSV 12978

NSV 12978 (=S 10685=TYC 01635.00042.1; R.A. $20^h 17^m 27\overset{s}{.}91$, Dec. +16° 53' 04".3, Equinox = 2000.0) was suspected to be a variable star of type RRc by Richter (1970). Using the SIMBAD database it was not possible to find further investigations of this object. We observed the star between JD 2452464 and JD 2452898, obtaining 316 CCD unfiltered measures. TYC 01635.00024.1 (11.14*V*) was used as comparison star and GSC 01635.00021 (11.98v) as a check. From these data it has been possible to define variation of an EW eclipsing binary and calculate its ephemeris, as follows:

$$\begin{array}{lll} \text{Min. I} = \text{JD} & 2452464.4087 & +\ 0.542565\,\text{E}. \\ & \pm 0.0055 & \pm 0.000009 \end{array} \tag{3}$$

The light curve (Figure 3) folded with the ephemeris (3) shows an amplitude of variation of 0.55 magnitude for the primary minimum and of 0.50 magnitude for the secondary one; the two maxima are of the same brightness. Four minima were observed (Table 2):

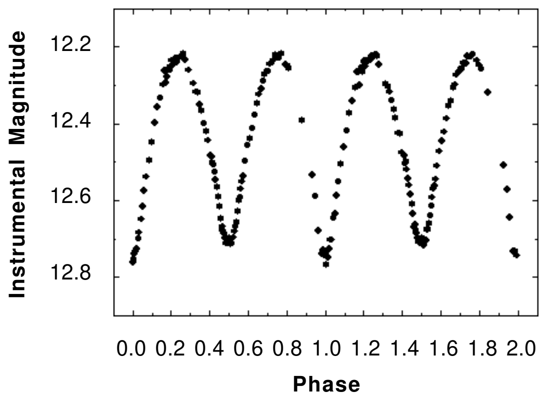

Figure 3. CCD light curve of NSV 12978.

Table 2. Times of minima of NSV 12978.

HJD	*E (3)*	*O-C (3)*
2452464.4090	0.0	0.0003
2452831.4480	676.5	–0.0062
2452847.4613	706.0	0.0014
2452850.4484	711.5	0.0044

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