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THE NEW OVERCONTACT ECLIPSING BINARY STAR NSV 07457

Following the program initiated by the Grup d'Estudis Astronomics in 1995 in cooperation with the Esteve Duran Observatory Foundation, for observing poorly studied variable stars, NSV 07457 was monitored in the V band for 13 nights, from 24 March 1996 to 26 May 1996, using a CCD camera attached to the 0.3-m telescope at L'Estelot Observatory in L'Ametlla de Mar (Spain). To perform differential photometry, GSC 3497.0310 and GSC 3497.0239 were chosen as comparison and check stars, respectively.

Geyer et al. (1955) indicated that NSV 07457 (=BD +50°2255 = CSV 007268 = BV 0103) was a possible RR Lyrae type variable with a photographic magnitude variation from $9\overset{m}{.}7$ to $10\overset{m}{.}4$. The star can be unambiguously identified with GSC 3497.0263, an object with a photovisual magnitude (PAL-V1 filter) of 10.07±0.40.

The present observations allowed to determine that NSV 07457 is not an RR Lyrae but an overcontact eclipsing binary star with a period over 11 hours. Primary minimum is an occultation with a depth of $0\overset{m}{.}54$ and secondary minimum is a transit with a depth of $0\overset{m}{.}51$. An O'Connell effect that amounts to Δm=Max. I−Max. II=−0.03 was also detected, where Max. I is at phase 0.25 and Max. II at phase 0.75.

The following ephemeris was also derived:

$$\begin{array}{c} \text{Min. I} = \text{HJD } 2450177.4767 + 0\overset{d}{.}41906 \times \text{E} \\ \qquad\qquad\quad \pm 0.0004 \quad \pm 0.00003 \end{array}$$

A preliminary model of NSV 07457 was computed using Binary Maker 2.0 (Bradstreet, 1993), applying the same analysis method described by Gomez-Forrellad and Garcia-Melendo (1996) after converting the phase curve to 200 normal points. The O'Connell effect and light curve asymmetries that frequently appear in overcontact binary systems are currently interpreted as bright or dark areas on the binary components. In this case, an initial unspotted solution was obtained, and finally a spotted model was recomputed.

Initially the following parameters were fixed to obtain the photometric solution: a mean surface temperature T_1=6000K, according to the spectral type G0 given by Kholopov (1982), and gravity darkening coefficients $g_1=g_2=0.32$ and bolometric albedos $A_1=A_2=0.5$, which correspond to stars with convective external layers. Limb darkening coefficients x_1 and x_2 were set to 0.6. Due to the lack of spectroscopic information about mass ratio, a search for the solution was carried out from q=3.0 to q=4.8 in mass ratio steps of 0.2.

Once the unspotted solution was reached, it was refined invoking a single spot. No further attempt was made to introduce more spots to improve light curve fitting. A colatitude of 90° was fixed. Spot radius, colongitude and temperature factor were adjusted. It was found that light curve was best modeled with a hot spot on the secondary component. Elements of the best solution are given in Table 1. Table 2 lists spot parameters. Figure 1 shows the light curve of NSV 07457, and Figure 2 depicts the synthetic light curve superimposed on normal points.

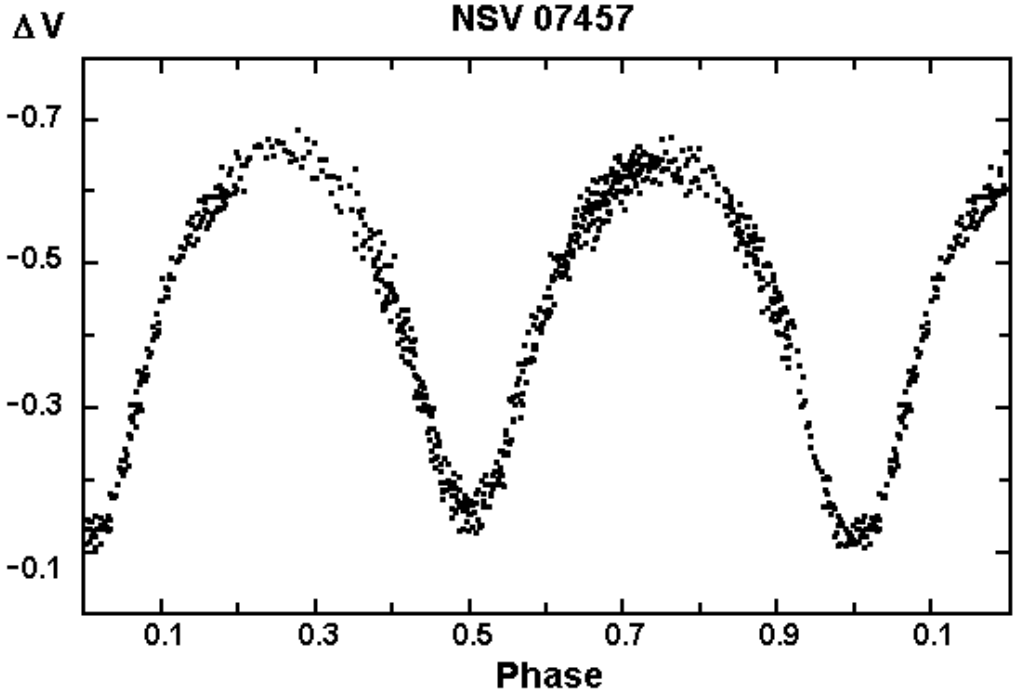

Figure 1

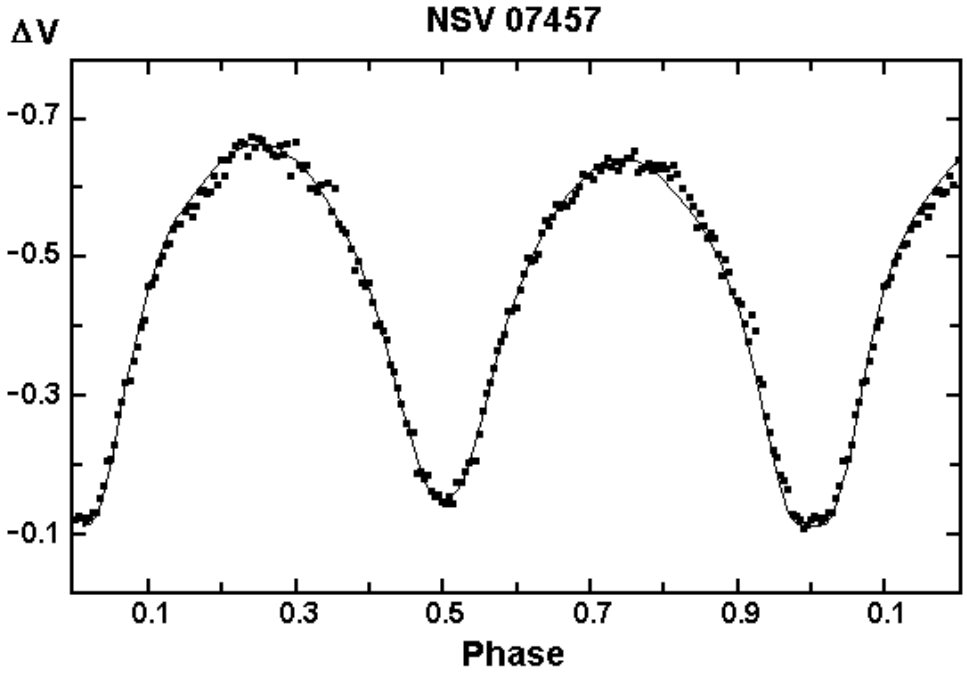

Figure 2

Table 1

mass ratio = 3.8 ± 0.2
i = 79°.0 ± 2°.0
fillout = 0.25 ± 0.10

$Omega_1$=$Omega_2$=7.499±0.200
a_g=0.543±0.011 a_s=0.315±0.001
b_g=0.515±0.010 b_s=0.274±0.001
c_g=0.475±0.008 c_s=0.262±0.001
d_g=0.633±0.005 d_s=0.367±0.005
g_1=g_2=0.32
x_1=x_2=0.6
A_1=A_2=0.5
T_1=6000K T_2=6280K±100K
L_1=0.720±0.01 L_2=0.280±0.007

Table 2

Colatitude = 90°
Colongitude = 45°
Spot Radius = 20°
T_f=1.14

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