THE VARIABLE LU VIRGINIS

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Abstract. LU Vir, classified as an ellipsoidal variable, was observed at the Bucharest Observatory in 2010. The observations were carried out with a 50cm Cassegrain telescope endowed with a CCD camera SBIG STL 11000. Our observations are the first ones obtained from the ground.

Key words: CCD photometry – variable stars.

1. OBSERVATIONS

LU Vir was discovered by the HIPPARCOS/TYCHO mission. The star is classified as ellipsoidal variable with a period of 0.492247 days and spectral type A0 (EAS 1997). The ellipsoidal variable stars are non-eclipsing close binaries whose components are distorted by their mutual gravitation. Though physically similar to the eclipsing variables, the ellipsoidal variables have orbital inclinations that are too small to create eclipses. Therefore, the light variations are due to the changing cross-sectional area and surface luminosities that the distorted star presents to the observer at different phases.

The star was observed at the Bucharest Observatory along 8 nights during the period 18.03 – 26.04.2010. We used a CCD camera of SBIG STL 11000 type, attached to the 50cm Cassegrain telescope at the Bucharest Observatory.

TYC 4965-1069-1 (V = 10.30, B = 11.30) and TYC 4965-591-1 (V = 10.50, B = 11.50) were used as comparison and check stars, respectively.

Taking the period given by the Hipparcos Catalogue and the epoch calculated by us, the observations were phased using the ephemeris:

$$Min\,\mathrm{I} = HJD\,2445281.54279 + 0.492247E \pm 0.00022\,. \qquad (1)$$

Apart from Hipparcos photometry, no light curves of the system have been published. Fig. 1 shows the observed light curves in B and V filters.

Fig. 2 presents the phased color index.

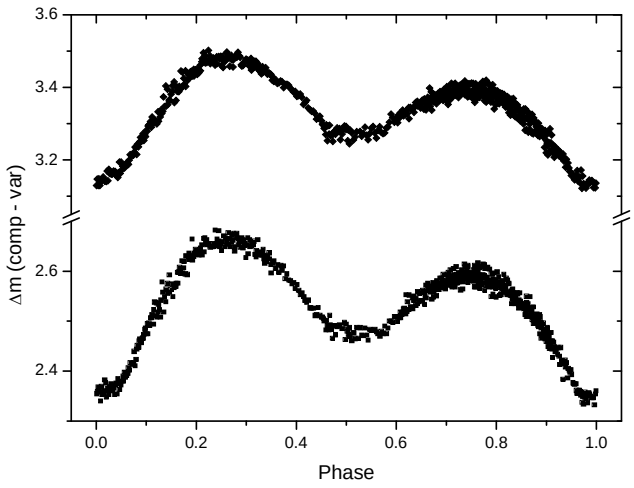

Fig. 1 – LU Virginis light curves observed in B (top, with diamonds) and V filters (bottom, with squares).

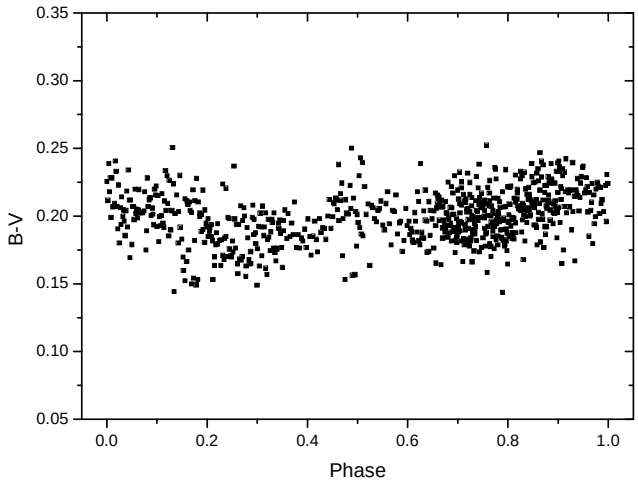

Fig. 2 – LU Virginis phased color index.

2. CONCLUSIONS

The light curves obtained by us exhibit a variation of about 0.3 mag and a large O'Connell effect ($\max_{II} - \max_{I} \cong 0.07\,\text{mag}$). Moreover, the time of secondary minimum is shifted towards larger phase by about $0.02P$; the same is observed for the second maxima. The depth of minima differs by 0.13 mag.

The large asymmetry of the light curve could be explained in two ways: the existence of a huge spot on one component or a nonsynchronous rotation (e.g., TV Pictoris). Because of the lack of spectroscopic information we cannot derive the physical elements in the classical way.

Generally, the light variation Δm of one distorted star is given by the relation (Kopal 1959; Morris 1985):

$$qr_{\text{m}}^3 \sin^2 i = 3.070\Delta m(3-u)/[(u_{\text{g}}+1)(15+u)]. \qquad (2)$$

In Eq. (2) r_{m} stands for mean radius of the star. For a given inclination i, Δm reaches its maximum value for the contact configuration and $q=1$, $u=1$, $u_{\text{g}}=1$. The maximum amplitude will be $\Delta m_{\max} = 0.251\sin^2 i$. If one considers both stars, the light variation of the system cannot exceed the above mentioned Δm, regardless to the configuration of the system. This assertion results from simple photometric reasons.

For LU Vir the light amplitudes of the primary minima are, in V and B, 0.31, respectively, 0.35 mag. These values result to be larger than the theoretical maximum amplitude, $0.251\sin^2 i$.

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