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# Physical parameters of the Algol system V621 Centauri from simultaneous analysis of GENEVA 7-colour light curves ☆,☆☆

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**Abstract**

The semi-detached eclipsing binary system V621 Cen ($P = 3.68$ d) has been analysed using the Wilson–Devinney program, on the basis of light curves obtained in the GENEVA 7-colour photometric system, and radial velocity curves for both components measured with the cross-correlation technique. The physical and orbital parameters have been determined through a self-consistent simultaneous solution of the photometric and radial velocity curves. The effective temperature of the primary component has been determined from the photometric analysis, $T_{\mathrm{eff}_1} = 15,600 \pm 800$ K.

The absolute elements of the components are for the primary (mass gainer), with the value of $T_{\mathrm{eff}_1}$ fixed, $M_1 = 6.10 \pm 0.10 M_\odot$, $R_1 = 4.58 \pm 0.01 R_\odot$, $M_{\mathrm{bol}_1} = -2.83 \pm 0.01$, and for the secondary (mass loser), $M_2 = 2.09 \pm 0.04 M_\odot$, $R_2 = 5.87 \pm 0.01 R_\odot$, $M_{\mathrm{bol}_2} = -0.86 \pm 0.01$, $T_{\mathrm{eff}_2} = 8750 \pm 20$ K. The semi-major axis $A$ of the relative orbit is $20.20 \pm 0.12 R_\odot$. The estimated spectral types of the components are about B3/4 V (primary) and A0/1III (secondary). The equatorial rotational velocity of the primary is 63 km s$^{-1}$. The distance to V621 Cen is evaluated to $1550 \pm 140$ pc, and the colour excess $E[B2 - V1]$ to $0.270 \pm 0.045$.


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## 1. Introduction

V621 Centauri (HD 122248, CPD −62°3858) is a semi-detached eclipsing binary of period $P = 3.684$ d, with an evolved secondary component. The total primary eclipse is 0.63 mag deep in the $V$ band. The variability of this system was discovered by H. van Gent (Hertzsprung, 1950), was announced in the 47th name-list of variable stars (Kukarkin et al., 1951), and is mentioned in the General Catalogue of Variable Stars (Kukarkin et al., 1969; Kholopov et al., 1985). Since then, this binary star was mentioned in the catalogues of Algol type systems, as, e.g., Budding et al. (2004) and Malkov et al. (2006). The first estimate of the spectral type of the primary star given in these catalogues is B8/9II/III. This classification is not confirmed by the detailed analysis made in this paper, which gives B3/4V for the primary and A0/1III for the secondary.

Very few parameters of V621 Cen are well known. No complete radial velocity curve has been yet published, and the complete analysis, based on the photometric and spectroscopic curves, was never performed. For that reason, this star was measured intensively in the 7-colour GENEVA

☆ Based on observations collected at the Swiss 70 cm and 120 cm telescopes at the European Southern Observatory (La Silla, Chile).
☆☆ Table 1 is only available in electronic form at the CDS via anonymous ftp to cdsarc.u-strasbg.fr (130.79.128.5) or via http://cdsweb.u-strasbg.fr/Abstract.html.

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Table 2
The seven mean GENEVA apparent magnitudes of V621 Cen, with the uncertainties (see Section 3), outside eclipses ($m_{A+B}(i)$) and at the bottom of the primary eclipse ($m_e(i)$)

| $i$ | Measured | | Calculated | | |
|---|---|---|---|---|---|
| | $m_{A+B}(i)$ | $m_e(i)$ | $f(i)$ | $m_A(i)$ | $m_B(i)$ |
| $U$ | $10.369 \pm 0.007$ | $11.129 \pm 0.013$ | 0.414 | $10.535 \pm 0.019$ | $12.493 \pm 0.129$ |
| $B1$ | $10.264 \pm 0.012$ | $10.959 \pm 0.011$ | 0.414 | $10.498 \pm 0.028$ | $12.046 \pm 0.136$ |
| $B$ | $9.390 \pm 0.009$ | $10.065 \pm 0.009$ | 0.414 | $9.647 \pm 0.022$ | $11.082 \pm 0.094$ |
| $B2$ | $10.885 \pm 0.014$ | $11.548 \pm 0.008$ | 0.414 | $11.156 \pm 0.032$ | $12.526 \pm 0.134$ |
| $V1$ | $10.834 \pm 0.012$ | $11.454 \pm 0.011$ | 0.422 | $11.143 \pm 0.031$ | $12.348 \pm 0.108$ |
| $V$ | $10.115 \pm 0.004$ | $10.741 \pm 0.009$ | 0.422 | $10.417 \pm 0.015$ | $11.653 \pm 0.050$ |
| $G$ | $11.251 \pm 0.008$ | $11.866 \pm 0.011$ | 0.422 | $11.567 \pm 0.023$ | $12.746 \pm 0.074$ |

$f(i)$ is the fraction of the flux of component $A$ visible at the bottom of the partial primary eclipse. $m_A(i)$ and $m_B(i)$ are the calculated magnitudes for components $A$ and $B$.

photometric system (Golay, 1980; Rufener, 1988; Burki et al., 2007) using the 0.70 m Swiss telescope at La Silla (European Southern Observatory, Chile) equipped with the two-channel aperture photometer P7 (Burnet and Rufener, 1979). Moreover, the radial velocity curve of each component has been determined with the spectrograph CORALIE installed on the 1.20 m Swiss telescope at La Silla.

In this paper, the physical parameters of the two components of this eclipsing system will be determined from the simultaneous analysis of light and radial velocity curves.

## 2. Period

The orbital period listed in the GCVS (Kholopov et al., 1985), is $P = 3.68357$ d. A new determination of the ephemeris was made on the basis of our extended photometric survey (1986–1991):

$$\mathrm{HJD(Min\ I)} = (2447646.2841 \pm 0.0021) + (3.683549 \pm 0.000011) \times E \quad (1)$$

Table 3
The calculated GENEVA colour indexes of V621 Cen A

| | |
|---|---|
| $[U-B]$ | $0.888 \pm 0.029$ |
| $[B1-B]$ | $0.851 \pm 0.036$ |
| $[B2-B]$ | $1.509 \pm 0.039$ |
| $[V1-B]$ | $1.496 \pm 0.038$ |
| $[V-B]$ | $0.770 \pm 0.026$ |
| $[G-B]$ | $1.920 \pm 0.031$ |

Table 4
The journal of the radial velocity observations of V621 Cen

| HDJ −2,400,000 | $V_r$ ($A$) (km s$^{-1}$) | $V_r$ ($B$) (km s$^{-1}$) | Phase |
|---|---|---|---|
| 51237.8243 | −25.506 | 6.860 | 0.0258 |
| 51241.7108 | −48.464 | 72.100 | 0.0809 |
| 51230.8127 | −51.030 | 116.000 | 0.1223 |
| 51245.7481 | −74.119 | 166.980 | 0.1769 |
| 51245.8321 | −81.195 | 177.750 | 0.1997 |
| 51234.8474 | −80.648 | 187.250 | 0.2176 |
| 51238.7226 | −72.504 | 193.460 | 0.2696 |
| 51227.8259 | −71.408 | 178.220 | 0.3114 |
| 51242.6895 | −63.049 | 165.710 | 0.3466 |
| 51231.7903 | −49.116 | 132.320 | 0.3877 |
| 51235.6609 | −27.900 | 60.270 | 0.4385 |
| 51235.8573 | −17.973 | 6.500 | 0.4918 |
| 51239.7057 | 13.144 | −63.330 | 0.5365 |
| 51228.8862 | 30.487 | −137.010 | 0.5993 |
| 51232.8903 | 47.405 | −191.400 | 0.6863 |
| 51236.6614 | 51.050 | −208.750 | 0.7101 |
| 51236.8950 | 59.294 | −207.160 | 0.7735 |
| 51240.7156 | 47.661 | −189.430 | 0.8107 |
| 51229.7961 | 43.995 | −166.100 | 0.8463 |
| 51240.8978 | 37.184 | −153.760 | 0.8602 |
| 51244.8011 | 28.468 | −95.502 | 0.9198 |
| 51233.7507 | 29.644 | −93.070 | 0.9199 |
| 51244.9016 | 21.611 | −68.560 | 0.9471 |

The phase is calculated by using $T_0 = 2451233.1250$ (see Table 5). The uncertainties are respectively, 6 km s$^{-1}$ and 4 km s$^{-1}$ for components $A$ and $B$.

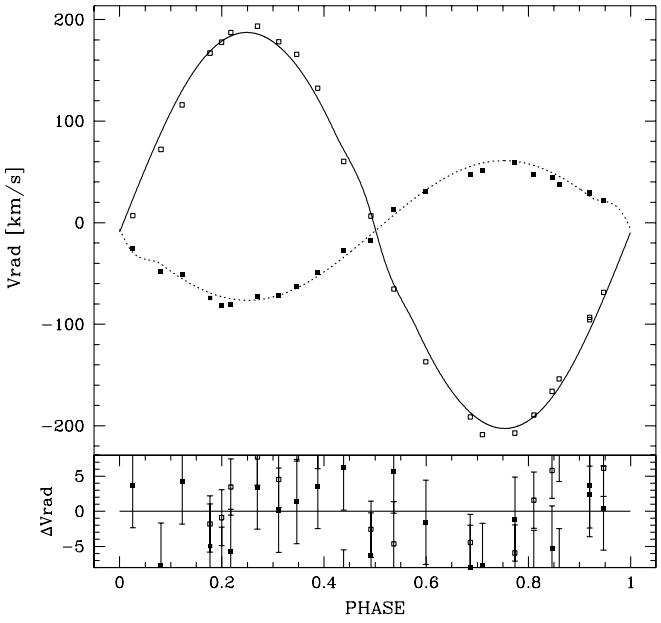


Fig. 1. Radial velocity curve and residuals of V621 Cen. The black squares refer to the primary component, and the open squares to the secondary. The adjusted curves result from the solution of the Wilson–Devinney program, based on the simultaneous photometric and radial velocity analysis (see Section 6). The uncertainties on the individual measurements are indicated.