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An OB-type eclipsing binary system ALS 1135

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Abstract. We present new physical and orbital parameters of an early-type double-lined eclipsing binary system ALS 1135. The $UBVI_C$ light curves and radial velocity curves were modeled simultaneously by means of the Wilson-Devinney code. As a result, we obtained inclination and size of the orbit, as well as masses, radii and effective temperatures of the components.

Keywords. stars: early-type, binaries: eclipsing

1. Introduction

ALS 1135 is a member of OB association Bochum 7 of the age of about 6 Myr located at the distance of 4.8 kpc (Sung *et al.* 1999). Corti *et al.* (2003) discovered that ALS 1135 is a single-lined spectroscopic binary with a period of 2.7532 d, and classified the main component as O6.5 V((f)). Fernández Lajús & Niemela (2006) found the presence of faint lines of secondary component and from the radial velocities of both stars and the ASAS photometry obtained the orbital solution and physical parameters of both components. Based on the ASAS photometry for ALS 1135, Pigulski and Michalska (2007) found additional periodic variations with frequency of 2.31095 d^{-1}. If these pulsations originate in the primary component, it would be the first O-type star among β Cephei class variables and an excellent object for asteroseismology. To confirm this result the photometric and spectroscopic campaign for this star was conducted.

2. Observations

The $UBVI_C$ observations of ALS 1135 were carried out with the 1-m telescope at the South African Astronomical Observatory (SAAO) during 13 nights between January 23 and February 5, 2008. Between November 2007 and January 2009, the BVI_C observations with 0.6-m Perth-Lowell Automated Telescope at Perth Observatory were taken.

The spectroscopic observations of ALS 1135 were carried out between 25 and 27 January 2008 with the ESO New Technology Telescope (NTT; La Silla, Chile) and the ESO Multi-Mode Instrument (EMMI) in the cross-dispersed échelle mode. Additionally, on 5th January 2008, a single spectrum of ALS 1135 was obtained with the MIKE spectrograph, attached to the 6.5-m Magellan-Clay Telescope at Las Campanas Observatory.

3. Analysis and Results

The orbital period found from our analysis is equal to 2.753189 d and the time of the primary minimum is equal to HJD 24552070.144(13). The search for variable stars around

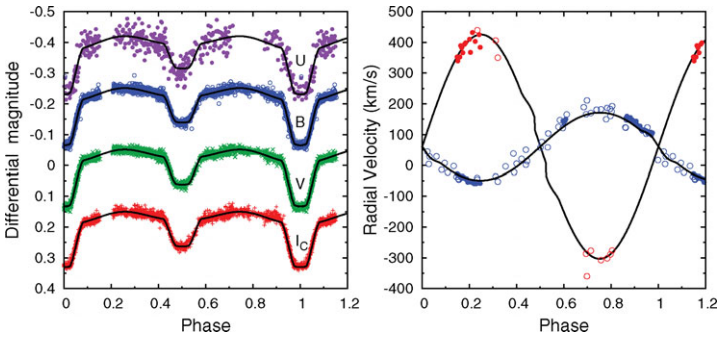

Figure 1. Light and radial-velocity curves of ALS 1135. Solid line represent the best fit.

ALS 1135 reveal that additional variations found by Pigulski & Michalska (2007) were originated in neighboring EW-type system which was not resolved in the ASAS data.

To obtain atmospheric parameters of the primary component we used a grid of fluxes calculated for TLUSTY model atmospheres for O-type star (Lanz & Hubeny 2003). The solar helium abundance, metallicity and a microturbulence velocity equal to $10\,\mathrm{km\,s^{-1}}$ were assumed. The temperature of the primary component was established to 37 500 K, $\log g = 3.8\,\mathrm{cm\,s^{-2}}$ and $v \sin i = 200 \pm 20\,\mathrm{km\,s^{-1}}$. The EMMI/NTT data were used to derive heliocentric radial velocities for both ALS 1135 components.

Our $UBVI_C$ light curves and radial-velocity curves (Fig. 1) were modeled simultaneously by means of the latest version of the Wilson-Devinney (W-D) code (Wilson & Devinney 1971). To the analysis we included also the radial velocities derived by Corti *et al.* (2003) and Fernández Lajús & Niemela (2006) (open circles in Fig. 1). The W-D code was run with geometry used for detached binaries. The albedos and gravity darkening coefficients was set to 1.0. We assumed circular orbit, synchronization and allowed no spots. The following parameters were adjusted during the fits: mass ratio (q), radial velocity of the mass center (V_γ), phase shift, surface potentials, effective temperature of the secondary component ($T_{\mathrm{eff},2}$), inclination (i) and monochromatic luminosity of the primary component. As a result of the modeling, we obtained new, more accurate orbital and physical parameters of the system: $q = 0.306(4)$, $a = 26.9(2)\,\mathrm{R_\odot}$, $i = 79.21(6)^\circ$, $V_\gamma = 63.4(9)\,\mathrm{km\,s^{-1}}$, $T_{\mathrm{eff},2} = 25\,900(70)\,\mathrm{K}$, $M_1 = 26.3(7)\,\mathrm{M_\odot}$, $M_2 = 8.1(6)\,\mathrm{M_\odot}$, $R_1 = 10.31(8)\,\mathrm{R_\odot}$ and $R_2 = 3.60(3)\,\mathrm{R_\odot}$.

The analysis of new photometric observation of ALS 1135 reveals that periodic variations with frequency 2.31095 $\mathrm{d^{-1}}$ found in this star from ASAS-3 data (Pigulski and Michalska 2007) are caused by contamination with neighboring EW-type system.

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References

Corti, M., Niemela, V., & Morrell, N. 2003, *A&A*, 405, 571
Fernández Lajús, E. & Niemela, V. S. 2006, *MNRAS*, 367, 1709
Lanz, T. & Hubeny, I. 2003, *ApJS*, 146, 417
Pigulski, A. & Michalska, G. 2007, *AcA*, 57, 61
Sung, H., Bessell, M. S., Park, B.-G., & Kang, Y. H. 1999, *Journal of Korean Astronomical Society*, 32, 109
Wilson, R. E. & Devinney, E. J. 1971, *ApJ*, 166, 605

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