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A NEW γ Dor CANDIDATE IN CRUX

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In January and March 1999 the Dutch 91-cm telescope at ESO, La Silla, was used for *uvby* CCD observations of the Wolf–Rayet star WR 46. The observations were carried out with a few data points each night during 28 nights distributed over three observing runs. During the data reduction process we found that one of the other stars in the field showed variability. This star is not listed as variable in SIMBAD or in the GCVS (Kholopov et al. 1985–88), including the subsequent name-lists (Kholopov et al. 1985, 1987, 1989; Kazarovets & Samus 1990, 1995, 1997; Kazarovets et al. 1993). The observed field is shown in Figure 1, where the new variable star is marked by an arrow. Its coordinates are $\alpha_{2000} = 12^{\rm h}05^{\rm m}19^{\rm s}$ and $\delta_{2000} = -62°03'45''$. A light curve from March 1999 is shown in Figure 2, together with the difference between the comparison stars. The overall *rms*–scatter in the comparison star light curve is about 3.5 mmag.

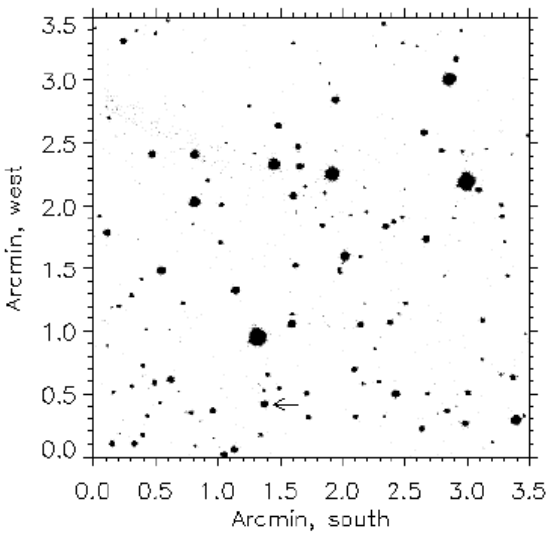

Figure 1. CCD frame covering the region where the new variable has been found (arrow). The bright star 0.′5 north of the new variable is WR 46.

At least two of the nights had photometric conditions. We used the star HD 303308, in the nearby η Car region, to determine the zero–point shift to the standard system using the photometry of Kaltcheva & Georgiev (1993). The average colour indices with estimated errors are:

$$y = 14.54 \pm 0.02$$
$$(b-y) = 0.43 \pm 0.02$$
$$m_1 = 0.04 \pm 0.03$$
$$c_1 = 0.71 \pm 0.05$$

The errors on the observed indices are rather large, mainly due to observational noise, but also due to the variability of this faint object. The Strömgren colour indices are consistent with a late A or early F star.

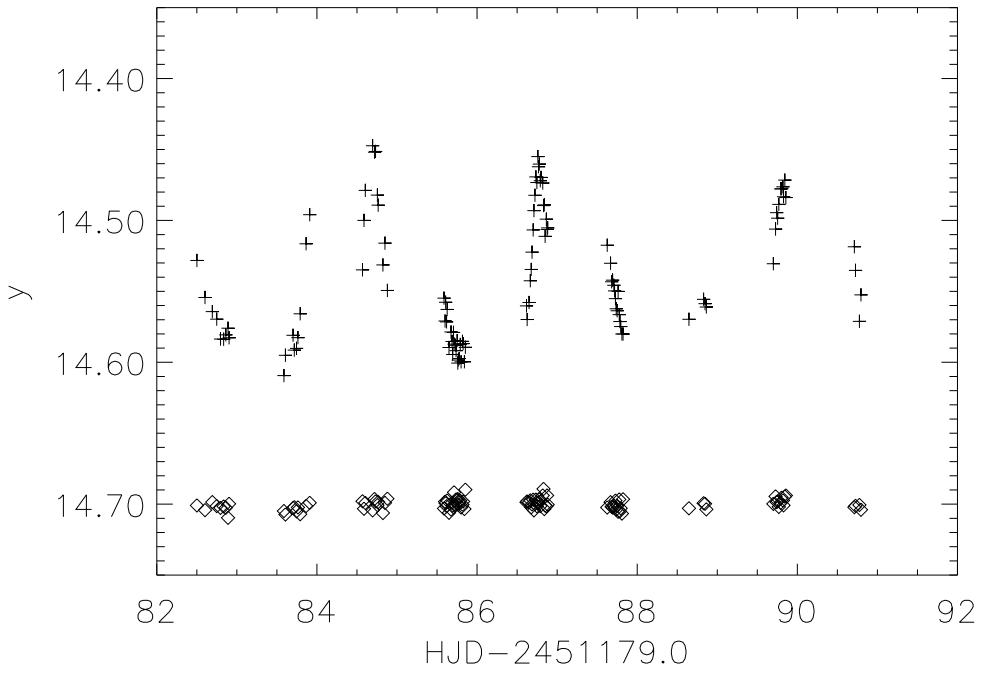

Figure 2. Light curve of the new variable. Crosses are the variable minus the average of two comparison stars, diamonds the difference between the two comparison stars (with shifted zero–point).

Fourier analysis of the y light curve reveals the presence of two frequencies. The first is at 15.77 μHz (1.363 c/d), corresponding to a period of $17^{\rm h}36^{\rm m}30^{\rm s}$, and with a semi–amplitude of 45.7 mmag. The second has a frequency of 17.93 μHz (1.549 c/d, $P = 15^{\rm h}29^{\rm m}38^{\rm s}$) and a semi–amplitude of 23.5 mmag. No excess power is left in the amplitude spectrum after these two frequencies have been subtracted from the light curve. The noise level at low frequencies in the residual spectrum is about 4.2 mmag. No peaks higher than about 2 mmag are present in the amplitude spectrum of the comparison stars. The spectral class, the multiperiodicity, and the periods and amplitudes of the variations, lead us to suggest that we are dealing with a variable star of the γ Doradus class.

γ Doradus variables are a new class of pulsating stars consisting of nonradial g-mode pulsators with periods between 8 hours and about three days. In the H–R diagram they cluster around the intersection of the red edge of the classical instability strip with the

main sequence (Handler 1999). Fig. 3 is the observational H–R diagram for the 11 γ Dor stars for which $uvby\beta$ photometry is available, with $(b-y)_0$ and $M_{\rm V}$ determined by the method of Moon & Dworetsky (1985). All known γ Dor stars have $2.705 < \beta < 2.767$ with an average $\beta = 2.730 \pm 0.022$. Using these limits for the reddening–free β index we obtain for the new variable average $(b-y)_0 = 0.21 \pm 0.01, M_{\rm V} = 2.8 \pm 0.6$ and $T_{\rm eff} \sim 7100$ K, leading to the position in the H–R diagram shown by the open symbol.

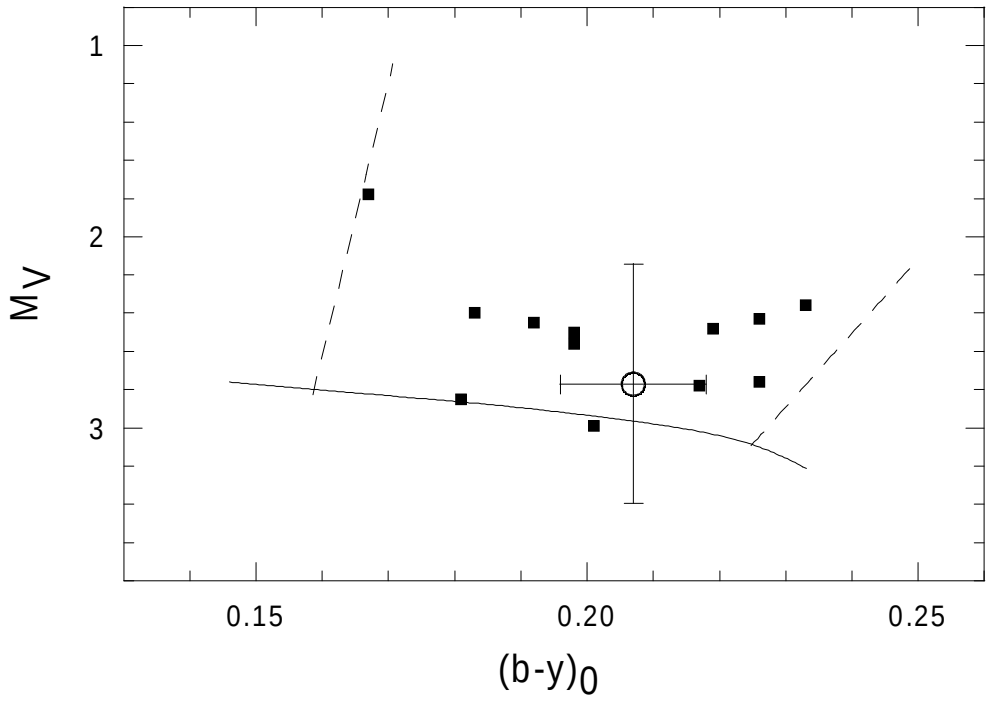

Figure 3. Observational H–R diagram: filled symbols are the positions for known γ Doradus stars, the open symbol denotes the location of the new γ Dor candidate. The error bars reflect the uncertainty due to the expected β range. The full line is the ZAMS line given by Crawford (1979), the dotted lines are the empirical borders of the γ Dor locus as given by Handler (1999).

Our colour indices also yield a surprisingly high $\delta_{m_0} \sim 0.07$ (a measure of blanketing for a given β that correlates well with metallicity [Fe/H]), the largest positive δ_{m_0} value known for γ Dor stars.

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