COMMISSIONS 27 AND 42 OF THE IAU
INFORMATION BULLETIN ON VARIABLE STARS

Number 5397

Konkoly Observatory
Budapest
27 March 2003

HU ISSN 0374 – 0676

A NEW BRIGHT HELIUM VARIABLE B STAR: HR 2949

RIVINIUS, TH.[1]; STAHL, O.[1]; BAADE, D.[2]; KAUFER, A.[3]

[1] Landessternwarte Heidelberg, D-69117 Heidelberg, Germany; e-mail: T.Rivinius@lsw.uni-heidelberg.de

[2] European Southern Observatory, Karl-Schwarzschild-Str. 2, D-85748 Garching bei München, Germany; e-mail: dbaade@eso.org

[3] European Southern Observatory, Casilla 19001, Santiago 19, Chile; e-mail: akaufer@eso.org

During a search for pulsational line profile variability in Bn stars, both components of the visual pair HD 61555/6 have been observed with FEROS at La Silla, Chile. While the results about Bn star variability will be reported elsewhere, the component with the lower $v \sin i$, HD 61556, was found to be spectroscopically variable.

A variability search in the photometric Hipparcos database (Koen & Eyer, 2002) revealed a period of $P = 1.9093$ d with an amplitude of $A = 0.0063$ mag. However, the Hipparcos identifier HIP 37229 corresponds to the combined light of both objects ($V = 3\overset{\mathrm{m}}{.}83$, Hauck & Mermilliod, 1998), while the components in fact have $V = 4\overset{\mathrm{m}}{.}53$ (HD 61555, B6 V) and $V = 4\overset{\mathrm{m}}{.}78$ (HD 61556, B5 IV), also taken from Hauck & Mermilliod (1998). The latter star has been suspected to be variable already by Kukarkin & Kholopov (1982, NSV 3673). For the folded Hipparcos light curve (Figure 1), we adopt

$$T_{\mathrm{min\ light}} = \mathrm{JD}\ 2448001.1 + E \times 1.9093$$

HD 61556 was observed spectroscopically four times with an exposure time of 300 seconds (Table 1). FEROS covers the wavelength range from 370 to 920 nm with a resolving power $R = \Delta\lambda/\lambda = 48\,000$ (Kaufer et al., 1997).

The equivalent widths of most lines, particularly the HeI lines, were found to be variable. Although the four spectra do not allow to derive the period independently, the two last spectra were taken one day apart. Since these latter two spectra roughly bracket the full observed range of variability, this supports a two day timescale in the equivalent width variations. In the following, we will, therefore, assume the photometric period also for the spectroscopic variations.

While the Balmer lines do not vary at all, the HeI lines are highly variable. When the star is bright the HeI lines are strong. Sorted by decreasing relative amplitude, lines of FeII, CII, and MgII vary in phase with HeI. Lines of SiII and SiIII vary in antiphase w.r.t. HeI.

Judging from the period and the nature of the spectral variations (Figs. 2 and 3), the star is likely a magnetic variable with a strong surface field having produced surface abundance inhomogeneities. Thus the period of 1.9093 d is the period of rotation. For a B5 IV star with a typical radius of $5\,\mathrm{R}_\odot$, this would imply $v_{\mathrm{rot}} \approx 130\,\mathrm{km\,s^{-1}}$. Since the equivalent widths of metal lines (Table 1) indicate this classification to be probably

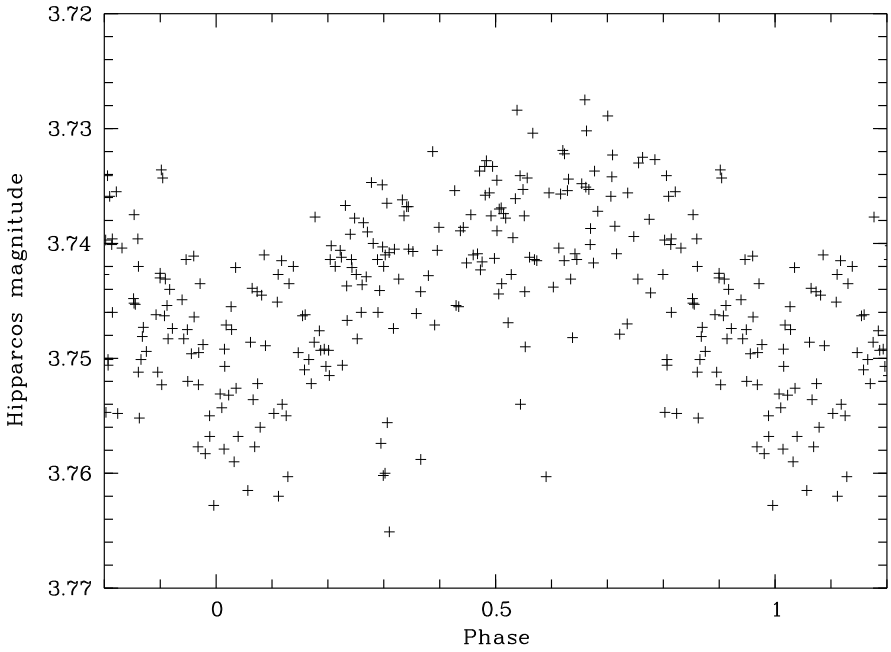

Figure 1. The photometry sorted with $P = 1.9093$ d. The Hipparcos magnitude differs somewhat from that in the V band. Note the outliers towards lower magnitudes are the result of partial disentanglement of the visual pair. For this reason also only measurements with a standard error of 0.01 mag or less are plotted.

slightly too cool, which is typical for undetected He-weak stars (Jaschek & Jaschek, 1987), the derived velocity should be a robust lower limit.

The width of the lines is about $v \sin i = 70\,\mathrm{km\,s^{-1}}$, which gives a relatively polar inclination of $i \approx 30°$ for the rotational axis.

Because the Hipparcos amplitude of 0.0063 mag corresponds to the variations of the combined light (around 3.83 mag), but the variable component is a star of only 4.78 mag, the real amplitude is higher by a factor of $10^{-0.4\times(3.83-4.78)} = 2.42$, i.e. about 0.015 mag.

These observations put HD 61556 among the brighter chemically peculiar B stars in the sky. Due to the photometric variability, it should be removed from the catalog of *uvbyβ* standard stars (Perry et al., 1987).

Table 1. Spectroscopic observations and measured equivalent width for several lines. Typical uncertainties are in the order of 5 %.

Phase	Julian Date	W_λ [mÅ]				
		HeI 4026	HeI 4471	HeI 6678	FeII 4549	SiIII 4553
0.04	2451151.770	700	680	230	64	91
0.28	2452686.511	740	590	220	61	96
0.61	2451196.764	1020	960	260	81	75
0.80	2452687.507	1000	890	250	81	77

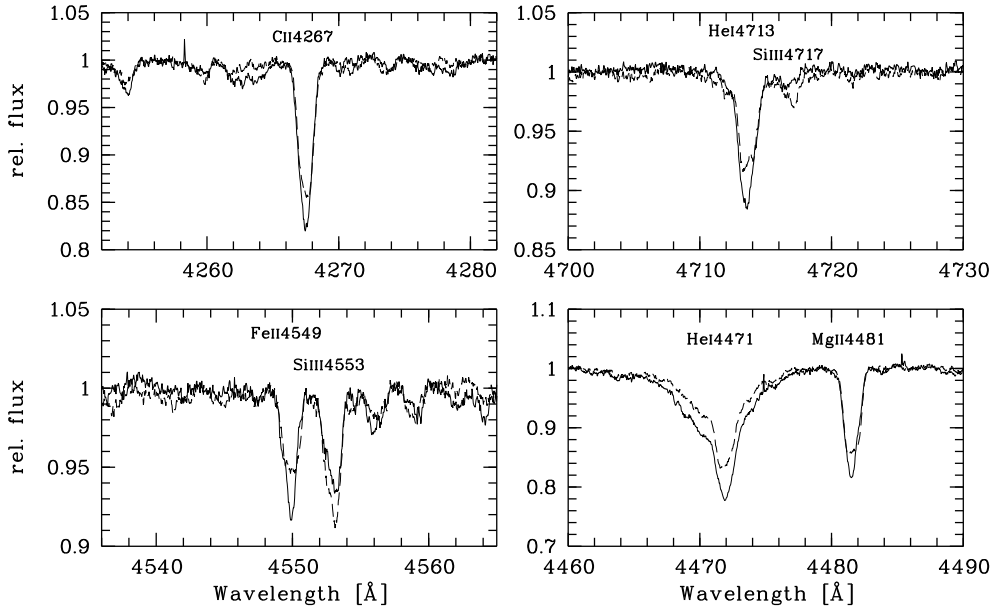

Figure 2. Spectroscopic line variations at phase 0.80 (full line) vs. phase 0.04 (dashed line). Most species behave like HeI, only Si lines vary in antiphase. Balmer lines are invariant.

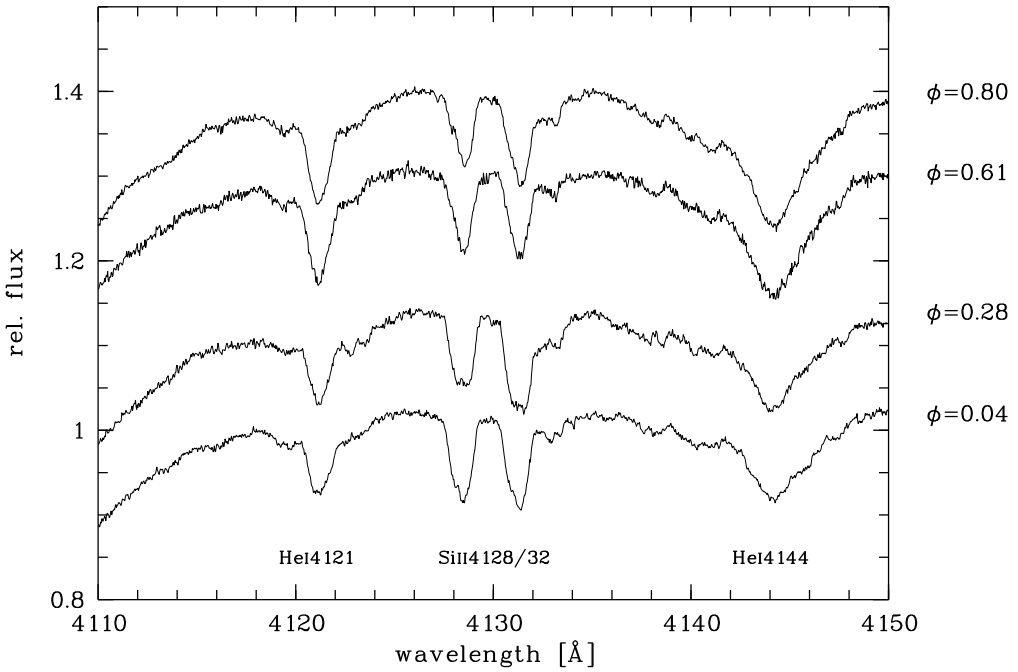

Figure 3. Variations of HeI and SiII lines. Note that not only the strength, but also the shape of the profile varies, as in the centre of the SiII lines.

References:

Hauck, B., & Mermilliod, M., 1998, *A&AS*, **129**, 431
Jaschek, C., & Jaschek, M., 1987, *"The classification of stars"*, Cambridge: University Press
Kaufer, A., Wolf, B., Andersen, L., Pasquini, L., 1997, *The ESO Messenger*, **89**, 1
Koen, C., & Eyer, L., 2002, *MNRAS*, **331**, 45
Kukarkin, B. V., & Kholopov, P. N., 1982, *"New catalogue of suspected variable stars"*, Moscow: Publication Office "Nauka"
Perry, C. L., Olsen, E. H., & Crawford, D. L., 1987, *PASP*, **99**, 1184