Stars and their variability observed from space
C. Neiner, W. W. Weiss, D. Baade, R. E. Griffin, C. C. Lovekin, A. F. J. Moffat (eds)

SOUTHERN BP-E STAR HD124448

M. Zboril[1]

Abstract. The atmospheres of early-type He-rich stars are believed to be non-standard in several respects. The He-rich star HD 124448 also shows UV and visual emissions. Perhaps it is the reason for the large uncertainty in its basic stellar parameters. Using both UV and ground-based observations, basic stellar parameters, evolutionary status, $v \sin i$ and elemental abundances are re-examined.

Keywords: Stellar atmosphere, stellar activity, stellar parameters

1 Introduction

He-rich stars (also called intermediate helium stars) typically posses light variations that are often supported by variations in the mean magnetic field. These stars are approximately B2 main-sequence stars. Besides having non-standard He atmospheres, they are likely to display both azimuthal and vertical He inhomogeneities. The abundance of helium and its evolutionary status were studied by Zboril et al. (1997), and a number of suspected He stars (HD 124448, HD 56139, HD 105435, CpD -62 2124) were found in our sample with emission at visual wavelengths (hydrogen profile). In an attempt to start studying these emissions we selected the Bp star HD 124448 from the sample.

2 Observations

To study helium stars, 155 spectra for 24 stars were obtained with the ESO 1.5-m telescope and the Boller-Chivens spectrograph. The spectra of HD 124448 were obtained over 4 nights (between January 5 and January 9 1993). It is important to note that emission in the hydrogen profiles (Hβ, Hγ, Hδ) was recognised in all spectra. The emission was constant and at the level of continuum. The *IUE* archive contains 7 low-resolution (swp) spectra that were obtained since 1978; variable emission in the Lyman-α profile was clearly detected in data.

3 Analysis and results

The basic characteristics of this star are certainly non-standard. It has unusual colour indices, a broad interval of spectral type and luminosity class, metallicity, a perhaps unknown projected $v \sin i$ and a small parallax of order 0.57 mas: see Table 1.

$(U-B)$	$(B-V)$	V	$T_{\rm eff}$	$logg$	$v \sin i$	[Fe/H]	note
-0.80	-0.09	9.98	16-27000 K	2-4	-	0.2 - 1.0	Simbad
-	-	-	16 000	4.0	44	0.8 He	this work

However, these characteristics are actually more complicated. For example, narrow-band and UBV photometry suggest that the effective temperature is of the order of 23000 K. A near-solar helium abundance and a large stellar radius (13 $R_{\rm sol}$) were reported for this star by Schoenberner & Wolf (1974),while oxygen underabundance and a hint of a cool circumstellar shell was proposed by Hill (1965). Furthermore, as the emission fills in the hydrogen profile, it is not possible to study the profile and adopt suitable model atmosphere. Strong UV resonance lines of Al and Si are not present in absorption.

We recall that an adequate model atmosphere for a star should undergo the following criteria: an agreement of absolute fluxes with observations at around 555.6 nm, relative fluxes at 120–500 nm, bound–bound hydrogen profiles, and fluxes in the infrared region. Our study was therefore very limited with respect to calculating a model atmosphere for the photosphere; the study consisted of the following steps: distance modulus $m-M$ (for

[1] Slovakia

the stellar radius), effective temperature from the radius and the absolute magnitude, synthetic UV spectra and observations for spectral type and metallicity, synthetic visual spectra and detailed line profiles for metallicity, individual abundances and projected $v \sin i$. The $v \sin i$ value was also studied in the Fourier domain.

The calculations were performed with the following software: an early PC version of the NLTE Synspec code (original reference: Hubeny (1992), Zboril (1996)) and adopted LTE model atmospheres, up-dated versions of our own software (Convol for a convolution, Sigma6 for Fourier transforms).

The basic stellar properties for the star were found to be:

- $T_{\rm eff} = 16\,000\,K$, $R/R_{\rm sol} = 4.07$, log g=3.9, $R/R_{\rm zams} = 1.19$ ($m - M$ modulus) inter-stellar absorption less than 0.3/kpc
- $T_{\rm eff}16\,000\,K$, log g 2.5-4.0, C, Si abundance non-solar (UV region)
- $T_{\rm eff}16000K$, log g=4.0, $A_{\rm C}$=2.4e-2, Mg=1.8e-4, Si=1.7e-4 (vis. region) He=0.8, Fe=4.8e-4, O=8.3e-3
- He I 4009, 4471, 4438 and 4713 give preliminary $A_{\rm He} = 0.83$

  In addition, rotational broadening is dominant; $v \sin i = 44$ km/s; there are variable emissions – hydrogen profiles and resonance UV transitions, and extra absorption is present in He line profiles and in a number of spectral type tracers (Mg II 4481, C II 4267, N II 4601), indicating possibly binary status or multiplicity for this star.

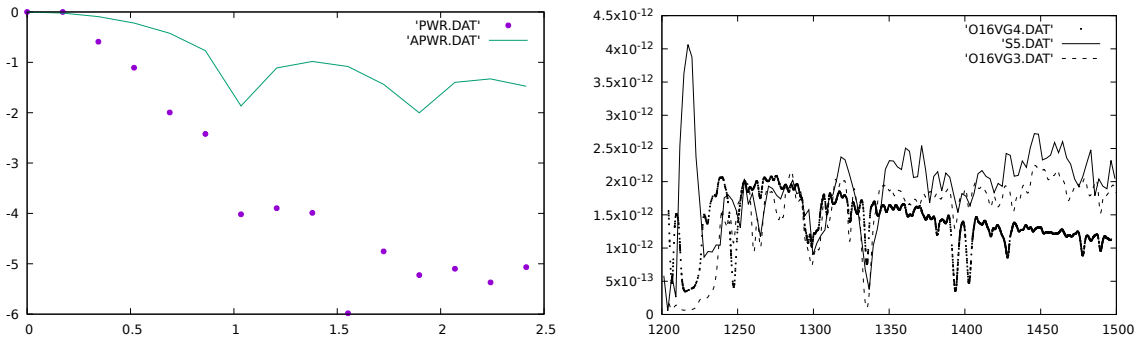

Fig. 1. Left: C II 4267 Å profile in the Fourier domain (dots); projected vsini value (solid line). **Right:** *IUE* swp 5789l spectrum (solid line); synthetic spectrum from a model for 16000 K, log g of 4 (dashed line), and model for 27000 K, log g of 4 (dots).

4 Conclusions

This star displays not only helium overabundace but overabundances of some light elements as well. According to the projected $v \sin i$ value, it belongs to the class of slower rotators. It is reported that the star is also pulsating. The overabundance seems to be better understood through the construction of an overall active atmosphere or shell joining the stellar photosphere.

I thank Vienna Observatory for financial support, and J. Krtička for his help in the final version of the poster. This work is based on observations obtained at ESO and with *IUE* (operated by NASA, SERC and ESA). This research has made use of the Simbad database, Strasbourg, France.

References

Hill, P. 1965, MNRAS, 129, 137

Hubeny, I. 1992, priv.com

Schoenberner, D. & Wolf, R. E. A. 1974, A&A, 37, 87

Zboril, M. 1996, ASP. Conf. Ser., 108, 193

Zboril, M., North, P., Glagolevskij, Y. V., & Betrix, F. 1997, A&A, 324, 949