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Christophe Martayan, Michele Floquet, Anne-Marie Hubert, Jean Zorec

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Michaela Kraus & Anatoly S. Miroshnichenko

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C. Martayan, M. Floquet, A.-M. Hubert

GEPI/UMR8111-Observatoire de Meudon, 5 place Jules Janssen 92195 Meudon cedex FRANCE

J. Zorec

Institut d'Astrophysique de Paris, 98bis, bd Arago 75014 Paris FRANCE

Abstract. We present optical spectroscopy of the emission line star BAL 224 (V=17.3, B-V=0.46). This star also named KWBBE 485, [MA93]906 is located at the periphery of the young SMC cluster NGC 330; it is known as a photometric variable with a possible period around 1 day (Balona 1992). Furthermore it was reported as the optical counterpart of the prominent mid-infrared source (MIR1) by Kucinskas et al. (2000), indicating the presence of a dust shell. The star was included in a sample of B-type stars observed using the ESO VLT-FLAMES facilities. The presence of emission lines such as Fe II,[Fe II], [S II] make this object like a B[e] star. The Hα, Hγ and Hδ lines show an asymmetrical double-peaked emission profile suggesting the presence of an accretion disk. Moreover the MACHO and OGLE light curves were analyzed; in addition to a long-term variability ($\simeq$ 2300d), a short period very close to 1 day has been detected using different methods, confirming the variability previously reported by Balona (1992). Finally the nature of this object is reconsidered.

1. Spectroscopic observations

Two spectra of BAL224 (α(2000), δ(2000): 00h 56mn 06.45s, -72^o 28' 27.70") were obtained at medium resolution in setups LR02 (396 - 457 nm, R=6400) and LR06 (644 - 718 nm, R=8600). They are dominated by the 2-peak emission components of Balmer lines which are strongly asymmetric with V>>R. Due to the resolution used it was possible, for the first time, to identify emission lines of [FeII], FeII, [CrI] as well as nebular lines [SII]6717, 6731 (see Fig 1). The mean radial velocity of these lines (RV) is 154 km s^{-1}. The FWHMs of metallic emission lines are about 100 km s^{-1} and correspond to the instrumental broadening. The low S/N ratio in the continuum (S/N$\simeq$20) did not allow to measure the radial velocity of HeI lines present in the spectra of BAL224. The RVs mean values of the shell component of Hα, Hγ and Hδ (see Figs 1, 2 and Table 1) is 187 km s^{-1}.

2. Photometric Variability

According to Balona (1992), this star displayed fading of 0.2 mag and periods close to 1 day but none of these periods could fit satisfactorily the data. Thanks

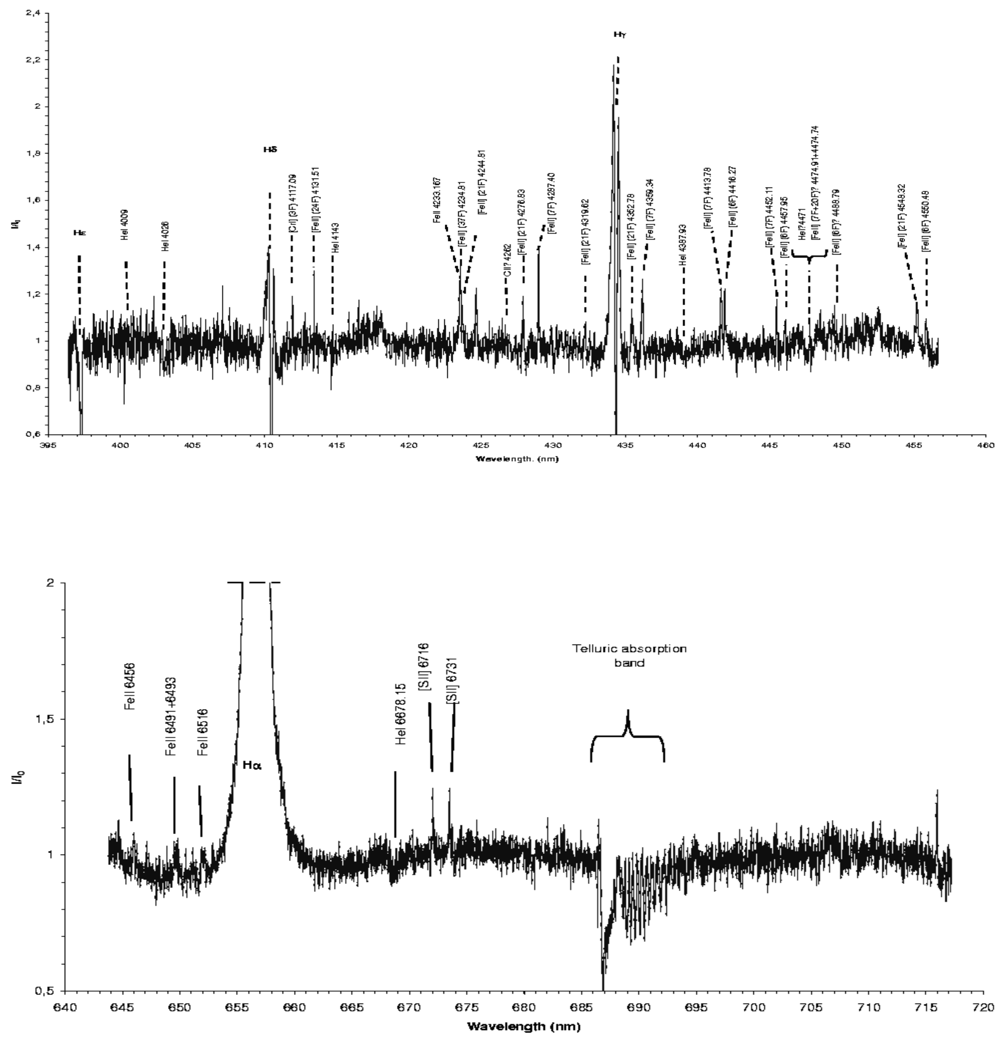

Figure 1. Top: Spectrum of the BAL224 in the LR02 VLT-GIRAFFE setting (R=6400). Bottom: Spectrum of the BAL224 in the LR06 VLT-GIRAFFE setting (R=8600).

to the MACHO and OGLE databases, 2 strong bursts (Fig. 3) could be observed with an amplitude of 0.4 mag on a time scale of about 3100 days. Between these 2 strong bursts, smaller ones which do not seen to be periodic could also be observed. We searched for short-term variability and like in Balona (1992) we find periods close to 1 day which do not give a satisfactory fit of the data. But irregular short- and long-term variabilities may also be explained by the presence of a multiple object.

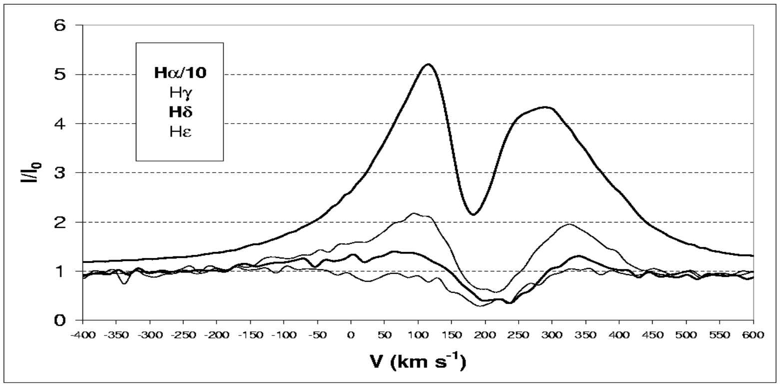

Figure 2. Radial velocities of Hα, Hγ, Hδ and Hϵ for BAL224.

Table 1. Observational indications such as radial velocities or intensities of lines in the spectra of BAL224. The values between brackets come from Hummel et al. (1999).

	Hα	Hγ	Hδ
RV_V (±20) km s^{-1}	104 [140 ±50]	86	62
RV_{shell} (±20) km s^{-1}	171	198	204
RV_R (±20) km s^{-1}	276 [301 ±50]	317	327
FWHM (±20) km s^{-1}	320 [443 ±50]	410	600
I_V	41.8	2.2	1.4
I_R	33.4	1.9	1.3
Mean I	37.6	2.1	1.4
EW (±20) Å	360 [202 ±20]		
Ratios	Hγ/Hα=0.055	Hδ/Hα=0.036	Hδ/Hγ=0.66

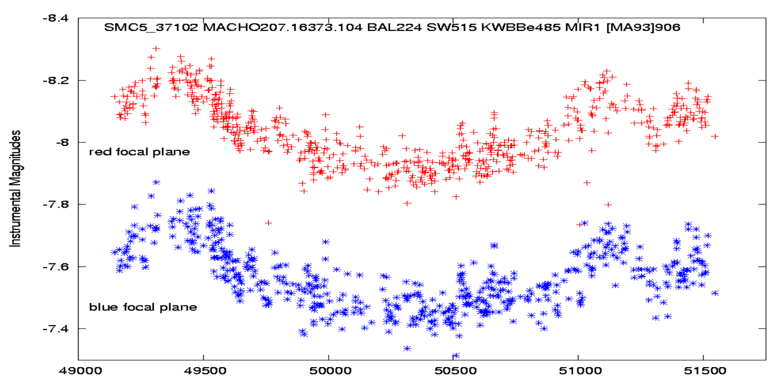

Figure 3. Light-curve of BAL224 from MACHO database.

3. On the nature of BAL224

From VLT-FORS1 low resolution spectroscopic observations Hummel et al. (1999) suggest that the absence of emission in HeI lines and the strong Balmer decrement can indicate that this star has a shell with a gas cooler than 5000K. Kucinskas et al (2000) thanks to their photometric study found a strong mid-IR excess compatible with a dust shell with a very low temperature: 360K. This infrared excess is compatible with B[e] and Herbig stars but the temperature determined is not compatible with B[e] stars. We confirm a strong Balmer decrement. No emission components can be observed on HeI lines and some lines of neutral elements such as [CrI] are present so we can conclude that a cool dust shell is present (Table 1, Figs 1, 2). The presence of FeII and [FeII] and their FWHM lower than 100 km s^{-1} are common points between B[e] and Herbig B[e] stars. But, we find an EW(Hα) smaller than 1000 Å, which does not correspond to a B[e]. The Hα spectrum seen in Hummel et al (2000) and in this study clearly shows a strong asymmetric double peak which may be explained by an accretion disk (Fig. 2). This type of disk is a main characteristic of Herbig objects. Moreover, the short- and long-term irregular variabilities are characteristic of Herbig objects which may be explained by an aggregate of stars. Properties of B[e] supergiants, HAeBe and isolated HAeBe (or HB[e]) are compared with properties of BAL224 in Table 2. From this comparison, **we propose BAL224 as an isolated Herbig B[e] object.**

Table 2. Comparisons between properties of: a B[e] supergiant (Sg), a Herbig Be (HAeBe), an isolated Herbig Be or HB[e] and BAL224.

Properties	B[e] Sg	HAeBe	HB[e]	BAL224
FeII and [FeII] lines in emission	Yes		Yes	Yes (this study)
FWHM FeII, [FeII]<100km s^{-1}	Yes			Yes (this study)
EW Hα >1000Å	Yes			No (this study + Hummel et al. 1999)
Near or far IR excess	Yes	Yes	Yes	Yes (Sebo & Wood 1994)
IR excess, $T_{envelope}$>1000K	Yes			No (Kucinskas et al. 2000)
Excretion disk	Yes			No (this study + Hummel et al. 1999)
In obscure region		Yes		No (Balona 1992)
A-type or earlier + emission lines		Yes		Yes (this study + Hummel et al. 1999)
Star illuminates nebulosity in immediate vicinity		Yes	Yes	?
Accretion disk		Yes	Yes	Yes (this study + Hummel et al. 1999)
Irregular variations		Yes	Yes	Yes (this study + Balona 1992)
Isolated object			Yes	Yes (Balona 1992)
Center of small aggregates of low-mass stars			Yes	?

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OGLE database, http://bulge.princeton.edu/ ogle/