

The evolutionary stage of five southern Galactic unclassified B[e] stars

Marcelo Borges Fernandes^{1,2}, Francisco X. de Araújo¹, and H. Lamers²

¹*Observatório Nacional, Rua General José Cristino 77, CEP: 20921-400, São Cristóvão, Rio de Janeiro, Brasil*

²*Sterrekundig Instituut, Universiteit Utrecht, Princetonplein 5, NL-3584 CC Utrecht, Nederland*

Abstract. The spectra of stars with the B[e] phenomenon are dominated by features that are related to physical conditions of circumstellar material around these objects and are not intrinsic to the stars. Because of this, they form a very heterogeneous group. This group contains objects with different evolutionary stages. Lamers *et al.* (1998) have suggested a new designation with five sub-groups, which indicate the evolutionary stage. They are: supergiants, pre-main sequence or Herbig Ae/Be, compact planetary nebulae, symbiotic and unclassified. The unclassified group has many objects that need a better study to resolve their evolutionary status. Forbidden lines can be a useful tool to solve this problem. They can give informations about chemical composition, ionization and density of the circumstellar medium and probably the evolutionary phase of these objects. We analyze spectra of some galactic objects, obtained with the FEROS and B&C spectrographs at the 1.52m telescope in ESO (La Silla-Chile), with a special focus on the forbidden lines. We have studied the spectra of five B[e] stars of uncertain evolutionary stage. We find that one of them is a pre-WN star, the other four are supergiant B[e] stars.

1. Forbidden lines

The presence of some forbidden lines is a criterion to distinguish different groups of massive stars. For example, LBV and sgB[e] have similar spectral characteristics, however, [O I] lines are present only in the sgB[e] (Zickgraf 1989). In the Table below we list the presence (✓) or absence (-) of some important forbidden

Table 1. Presence or absence of forbidden lines in unclB[e] stars.

object	[O I]	[O II]	[O III]	[S II]	[N II]	[Fe II]
HD 87643	✓	-	-	✓	-	✓
Hen 3-847	✓	-	-	✓	✓	✓
GG Car	✓	-	-	-	✓	✓
MWC 300	✓	-	-	✓	✓	✓
HD 326823	-	-	-	✓	✓	✓

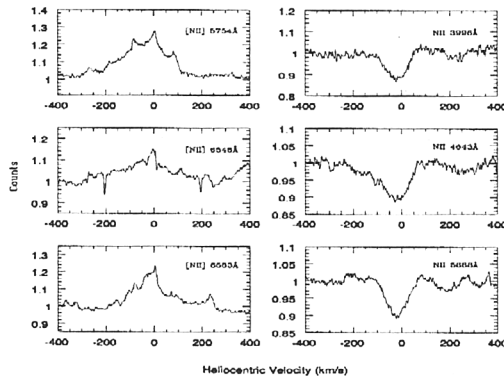


Figure 1. Profiles of N II lines in the high resolution spectrum (ESO/ON-FEROS) of HD 326823. The permitted lines are in absorption, indicating a photospheric origin, and the forbidden are in emission, indicating a circumstellar origin.

lines. Figure 1 shows the profiles of forbidden and permitted N II lines in the spectra of HD 326823.

2. The evolutionary phase of unclB[e] stars

From the comparison with spectra of well-established groups, it is possible to derive the evolutive stage of these five unclB[e] stars:

HD 326823: its He overabundance indicates that it is an evolved star. In agreement with the literature, we suggest that it is a pre-WN star with the B[e] phenomenon (Fernandes *et al.* 2001). This suggests a new class of B[e] stars;

HD 87643: there is a doubt if it is a pre-main sequence or a supergiant object. The absence of inverse P-Cygni profiles and absence of a strong variability suggest an evolved star, as sgB[e];

Hen 3-847: this object used to be classified as a pre-main sequence star. However, our spectra do not show any characteristic feature of young objects. We suggest that it is a sgB[e] candidate;

GG Car: this star was classified as sgB[e], but some authors consider it as a binary system, with a B-type star and a K-type star. Our spectra do not show any feature from the late type star. So we suggest that it is a sgB[e].

MWC 300: this object is classified, in the literature, as sgB[e] candidate. Our analysis of its spectrum confirms that suggestion.

We have started a study of the physical properties and parameters of the circumstellar material of those objects.

References

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