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THE WFI Hα SPECTROSCOPIC SURVEY

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Abstract. This document presents the results from our spectroscopic survey of Hα emitters in galactic and SMC open clusters with the ESO Wide Field Imager in its slitless spectroscopic mode. First of all, for the galactic open cluster NGC6611, in which, the number and the nature of emission line stars is still the object of debates, we show that the number of true circumstellar emission line stars is small. Second, at low metallicity, typically in the Small Magellanic Cloud, B-type stars rotate faster than in the Milky Way and thus it is expected a larger number of Be stars. However, till now, search for Be stars was only performed in a very small number of open clusters in the Magellanic Clouds. Using the ESO/WFI in its slitless spectroscopic mode, we performed a Hα survey of the Small Magellanic Cloud. 3 million low-resolution spectra centered on Hα were obtained in the whole SMC. Here, we present the method to exploit the data and first results for 84 open clusters in the SMC about the ratios of Be stars to B stars.

1 Observations, data-reduction, and spectroscopic analysis

Observations were performed in 2002, at the 2.2m of the ESO at la Silla equiped with the Wide Field Imager in its slitless spectroscopic mode (Baade et al. 1999). This kind of instrumentation is not sensitive to the ambient diffuse nebula and displays only emission lines, which come from circumstellar matter like in the case of Be stars. Be stars are very fast rotating stars, which are surrounded by a circumstellar decretion disk. This instrumentation allowed Martayan et al. (2008a) to find true cirumstellar emission line stars in the Eagle Nebula and NGC6611 open cluster located in the Milky Way, while slit-spectroscopic observations show strong nebular lines. Only a small number of true emission line stars (less than 10) was found.

In the Milky Way, we used broad bandpass filter centered in Hα, but in the Magellanic Clouds due to the crowding of the fields, we used a narrow bandpass filter also centered in Hα. The exposure times range from 120 to 600s, and the resolving power is low ($\sim$100). In the SMC, 14 images were obtained, $\sim$8000 spectra were treated in 84 SMC open clusters among the 3 million obtained for the whole SMC, and in NGC6611 $\sim$10000 spectra were treated. In the LMC, 5 million spectra were obtained.

The data-reduction was performed using IRAF tasks and the spectra extraction with SExtractor (Bertin & Arnouts 1996). The analysis of spectra and emission line stars detection were done using lecspec and ALBUM codes by Martayan et al. (2008a,b). To classify the stars in SMC open clusters, we cross-correlated our WFI catalogues with OGLE ones (Udalski et al. 1998) to obtain the photometry (B, V, I) for each star and various information for each open cluster (E[B-V], age, reddening). More than 4000 stars of SMC open clusters were classified. An example of colour-magnitude digrams is shown for different open clusters in the SMC in Fig. 1.

2 Metallicity effect

At low metallicity, the stellar winds are less efficient than at high metallicity, as a consequence the stars retain more angular momentum and rotate faster in the SMC than in the MW (Martayan et al. 2007, Hunter et al. 2008). It is then expected that there are more Be stars in the SMC than in the MW. To enlighten this

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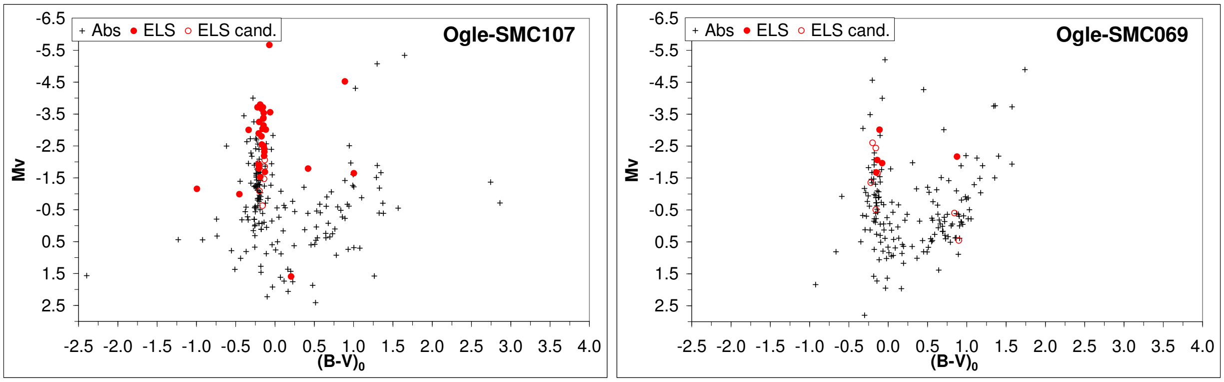

Fig. 1. Left: SMC open cluster OGLE-SMC107 (NGC330). **Right**: SMC open cluster OGLE-SMC069. Black dots correspond to the absorption stars, red full circles to definite emission line stars, and red empty circles to candidate emission line stars.

potential effect, the stars from 83 of the 84 open clusters treated in the SMC were grouped in order to avoid the variability of the rates of Be stars to B stars from a cluster to another. The rates of Be stars to B stars by spectral-type categories are then compared with those obtained in the Milky Way with data from McSwain & Gies (2005, 55 open clusters). In each spectral-type category, the proportion of Be stars to B stars is twice to 4 times higher in the SMC than in the MW. This result quantifies the trend seen in the preliminary studies of Maeder et al. (1999) or Wisniewski & Bjorkman (2006). About Oe stars, the rate is ∼1.5 times higher in the SMC than in the MW.

Furthermore, the distribution of the Be stars by spectral types peaks at the spectral-type B2 in the SMC open clusters. The same behaviour is seen for early-type Be stars in the MW (Zorec & Frémat 2005 in the field or in open clusters with data from McSwain & Gies 2005).

3 Conclusion

We conducted a large slitless spectroscopic survey in the Magellanic Clouds and in 2 open clusters in the Milky Way with the ESO/WFI in its slitless spectroscopic mode. In the open cluster NGC6611 and the Eagle Nebula (M16), we show that there is only a small number of true emission line stars. With the stars from 83 open clusters in the SMC, we show that there are twice to four times more Be stars in the SMC than in the MW open clusters. The exploitation of the spectra in the SMC field and in the whole LMC (field and open clusters) is currently ongoing.

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