Be stars in open clusters in the Small Magellanic Cloud.

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Abstract. We report on the study of the population of B and Be stars in SMC young clusters, performed with the Wide Field Imager in slitless spectroscopic mode at ESO/T2.2m with a filter centered at Hα. First, we explain the reduction methods we used and our selection of different types of objects. Second, we present results on the proportion of Be stars in SMC clusters, and we compare this proportion to the one observed in the Milky Way. Finally, we also present results on a statistical study of variability of Be stars with OGLE.

1 Introduction

The main goal of these observations is to draw a map in age and metallicity of the Be phenomenon accross the Large and Small Magellanic Clouds. Until now, only partial studies have given indices about the dependency of the Be phenomenon with the metallicity. With the ESO WFI in slitless spectro. mode we obtain an exhaustive survey of the Emission line stars. By cross-correlation with photometric databases, we obtain the photometry and classify the stars and give answers about the origin of the Be phenomenon.

2 Data Reduction

Due to the WFI mode we used, no pipeline was available to reduce the data. We thus used the SExtractor software (Bertin & Arnouts 1996) to extract the spectra (in the SMC 1 million of spectra are used for this study among 3 millions available in the images). To recognize and distinguish emission line stars (Em*) from other types of stars, we created the ALBUM code. To take into account the defocusing across the image, this code calculates the local average profile of the spectra for 50-250 isolated non Em* bright stars. The average profile is subtracted from each individual profile. In the resulting image, two peaks appear in the case of Em*: one is due to Hα emission, the other is the residual of the filter due to the profile disturbed by emission. In case of non Em*, residuals of the subtraction are only due to the noise or non perfect shifts. We treated 86 SMC clusters with log(t) from 7.0 to 9 and known E[B-V] taken from the OGLE survey (Pietrzynski et al. 1999), which represent 7741 stars. In addition, we obtained the astrometry with the ASTROM package (Wallace & Gray 2003) with an accuracy of 0.5-1". Then, we cross-correlated the catalogue of stars for each treated cluster to the OGLE catalogue (Szymanski 2005, Udalski et al. 1999, Pietrzynski et al. 1999) and we obtained the V, B and I magnitudes. We also used the distance modulus (Udalski et al. 2000) of the SMC and the calibration of Lanz (1991) to classify the stars.

3 Be stars in open clusters in the SMC: statistics, variability

3.1 Proportions

To study the effect of low metallicity on the Be phenomenon, we compare the proportions of Be stars (Be/B+Be) in open clusters in the SMC and MW (McSwain & Gies 2005) by spectral types. We find that the lower the

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metallicity, the higher the rate of Be stars. This could be explained by higher rotational velocities in the SMC than in the MW (Maeder & Meynet 2001, Martayan et al. 2006). We also compare the ratios of Be stars by spectral types to their total number. Our sample ranges mainly from B0 to B6 (for late types there is a lack of detection due to the low S/N in their spectra). In the SMC as in the MW (Zorec & Frmat 2005, Be stars in fields) the occurrence of Be stars in the 2 galaxies shows a maximum at B2 as shown in Fig. 1 left.

3.2 Variability

We investigated the long- and short- term variability of Be stars in the SMC. From the OGLE database, we obtained light curves for 169 Be stars. The degree of variability of Be stars in the SMC, as shown in Fig. 1 right, is higher for early types stars as in the MW (Hubert & Floquet 1998).

4   Conclusions

We obtained catalogues of Em* in 90 SMC open clusters. We found an effect of metallicity on the proportion of Be stars. There are more Be stars by spectral types in the SMC than in the MW compared to B stars. The distribution of Be stars versus spectral types is the same in the SMC and in the MW. Early Be stars vary more than late-types in the SMC as in the MW. The LMC is under investigation.

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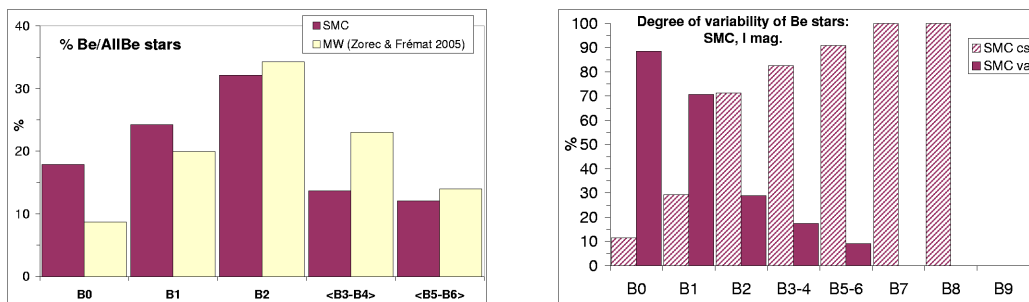Zorec, J. & Frémat, Y., 2005, sf2a2005, 361

Fig. 1. Left: Proportions of Be stars to the other Be stars by spectral types in the SMC and in the MW (Zorec & Frémat 2005). Right: Degree of variability from the OGLE I-band of candidates Be stars in the SMC open clusters.