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Where do Be stars stand in the picture of rotational mixing?

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Abstract. Atmospheric parameters and photospheric abundances have been estimated for 60 Be-type stars located in 4 fields over the Magellanic Clouds. Particular attention has been given to the absolute nitrogen abundances to test theories of rotational mixing, an important factor in the evolutionary status of B-type stars, Hunter *et al.* (2008). The analysis used the non-LTE atmospheric code TLUSTY and required the implementation of a procedure to compensate for possible contamination due to the presence of a circumstellar disc. Through comparison with evolutionary models of fast rotating B-type stars and projected rotational velocity distributions our results support the theory that Be-type stars are typically faster rotators than B stars, but the measured nitrogen enhancements appear to be significantly less than expected for Be stars rotating with velocities greater than 70% of their critical velocity

Keywords. stars: emission-line, Be, stars: atmospheres, stars: rotation, stars: evolution, stars: abundances, (galaxies:) Magellanic Clouds

1. Introduction

Be-type stars are defined as B-type stars that shows or has previously shown prominent Balmer emission features, indicating the presence of a circumstellar disc. Although the mechanism of the phenomenon is still unclear, such stars are believed to rotate with velocities close to breakup velocity. Nitrogen can be used to determine the degree of mixing due to the rate of rotation.

2. Analysis and Discussion

Rotationally broaden profiles were used to obtain vsini estimates. The non-LTE code TLUSTY was used to estimate the effective temperature, surface gravity and microturbulence of 30 Be stars which presented observable nitrogen absorption lines. Effective temperature, surface gravities shown in Fig. 1. A procedure was developed to compensate for possible disc contamination, requiring the following assumptions:

- **Contamination is a constant featureless continuum**
- **Uniform over spectral range observed**

A comparison was made between B and Be star vsini distributions. That supported previous results yielding a 17% fraction of Be stars. Vsini distributions were modeled with Gaussian functions in order to obtain the intrinsic rotational velocity distribution (Figure. 2).

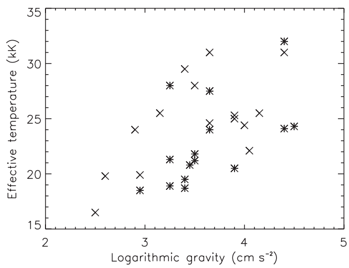

Figure 1. Effective temperature and surface gravity estimates plotted for the SMC (crosses) and LMC (stars) targets.

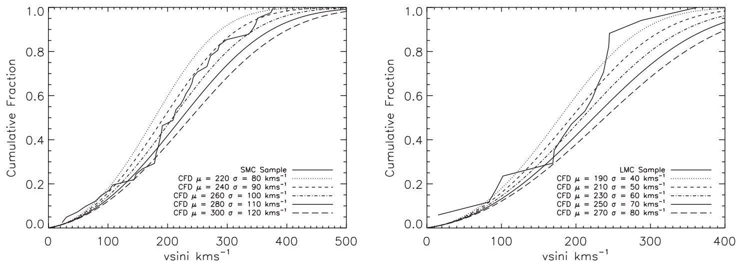

Figure 2. Cumulative fraction distributions for a range of Gaussian distributions based on the central velocity and width of the sample. SMC (**left**) LMC (**right**)

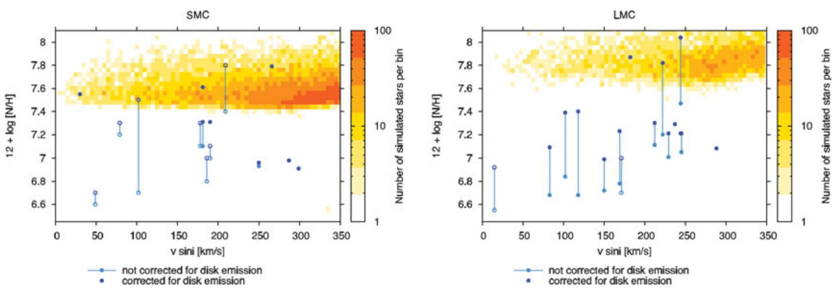

Figure 3. Nitrogen abundances and projected rotational velocities plotted for the SMC (**left**) and LMC (**right**) Be star samples before and after contamination correction. Also shown are the results of a simulation for evolutionary models of B stars with>70% breakup velocity (Brott *et al.*, in prep.).

Projected rotational velocities and absolute nitrogen abundances are plotted against a simulation of the expected nitrogen abundances and current vsini for B stars initially rotating with >70% of the breakup velocity (Fig. 3).

Our principle conclusions can be summarized as follows:

• Be stars appear to rotate faster than B stars, with more in the SMC.

• Nitrogen abundances appear inconsistent with initial rotational velocities close to breakup velocities.

Reference

Hunter, I., Lennon, D. J., Dufton, P. L., Trundle, C. *et al.* 2008a, *A&A*, 479, 541

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