

Does rotation of B stars depend on metallicity? preliminary results from GIRAFFE spectra

Frédéric Royer¹, Pierre North², Claudio Melo³, Jean-Claude Mermilliod²,
Eva K. Grebel⁴, Jose Renan de Medeiros⁵, and André Maeder⁶

¹ GEPI / CNRS UMR 8111, Observatoire de Paris, F-92195 MEUDON cedex, France

² Laboratoire d'Astrophysique, Ecole Polytechnique Fédérale de Lausanne (EPFL),
Observatoire, CH-1290 Sauvigny, Switzerland

³ ESO, Alonso de Cordova 3107, Casilla 19001, Santiago 19, Chile

⁴ Astronomisches Institut, Universität Basel, Venusstr. 7, CH-4102 Binningen,
Switzerland

⁵ Universidade Federal do Rio Grande do Norte, 59072-970 Natal, R.N., Brazil

⁶ Observatoire de Genève, CH-1290 Sauvigny, Switzerland

Abstract. We show the $v \sin i$ distribution of main sequence B stars in sites of various metallicities, in the absolute magnitude range $-3.34 < M_V < -2.17$. These include Galactic stars in the field measured by [1], members of the η & χ Per open clusters measured by [6], and five fields in the SMC and LMC measured at ESO Paranal with the FLAMES-GIRAFFE spectrograph, within the Geneva-Lausanne guaranteed time. Following the suggestion by [5], we do find a higher rate of rapid rotators in the Magellanic Clouds than in the Galaxy, but the $v \sin i$ distribution is the same in the LMC and in the SMC in spite of their very different metallicities.

1 Introduction, results and conclusion

This work aims at testing the suggestion of [5] that stellar rotation is faster at lower metallicity by direct measurements, especially in the LMC and SMC, on stars with $-3.34 < M_V < -2.17$, i.e. spectral types B0-B6 or masses from ~ 6.7 to $14 M_\odot$. This work is complementary to that of [4], which deals with slightly more massive stars. The results are shown on Fig. 1 and commented in the caption. There is an excess of slow rotators in the Galaxy relative to the MCs, but the $v \sin i$ distributions of the LMC and the SMC are surprisingly similar.

References

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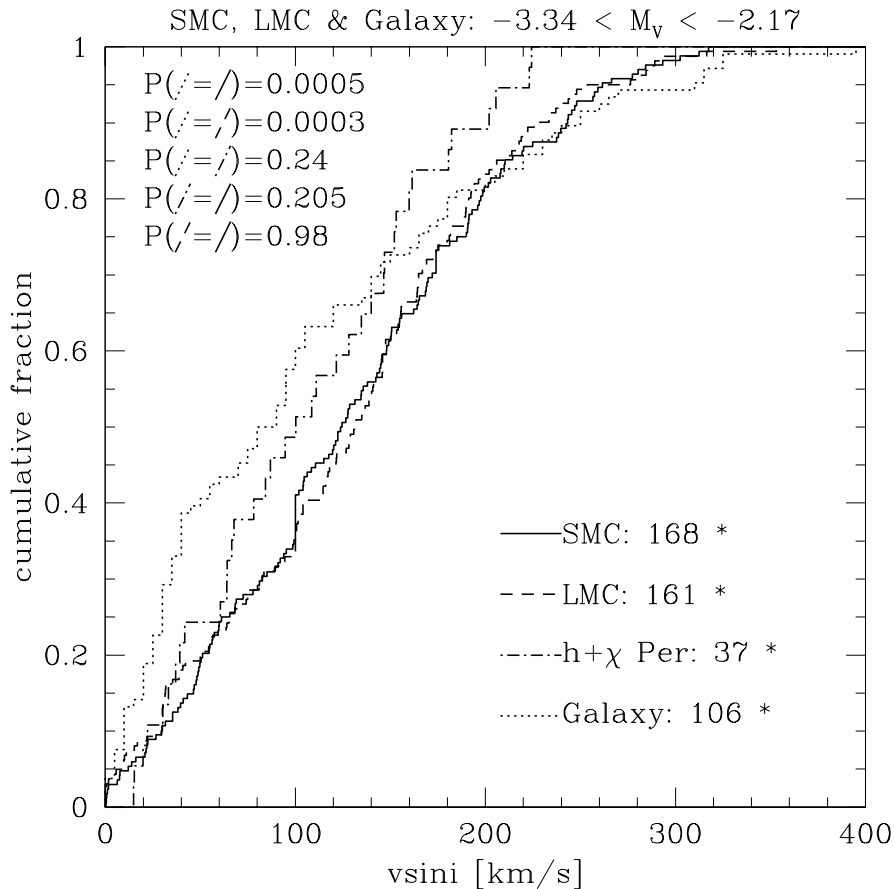


Fig. 1. Cumulative $v \sin i$ distributions for Galactic stars in the field (dotted line), for members of the h & χ Per clusters (dash-dot) and for stars in the LMC (short dash) and in the SMC (solid line). The GIRAFFE spectrograph, attached to the UT2 telescope (VLT) and used in the L2 setup ($R = 6400$, $\lambda_c = 4272 \text{ \AA}$), was used on 3 fields in the LMC (centered on $[\alpha_{J2000} = 05:31:40, \delta_{J2000} = -66:59:48]$, on $[05:30:40, -67:17:12]$ and on $[05:03:48, -69:00:36]$) and 2 fields in the SMC (centered on $[00:56:12, -72:29:00]$ and on $[00:49:26, -73:12:07]$). We fitted synthetic spectra to observed ones in the range $4460 - 4490 \text{ \AA}$ with the technique described by [3] using an average $T_{\text{eff}} - M_V$ relation for the main sequence and assuming $\log g = 4.0$. The resulting $v \sin i$ values were then transformed to the scale of [7]. For the Galaxy, we defined the $v \sin i$ distribution using 1) the measurements made in the h & χ Per clusters by [6] and 2) the large sample of [1] of bright field B stars, Geneva photometry being used to determine M_V through the calibration of [2]. The SB2 systems were eliminated from this sample, which, although magnitude-limited, does not significantly differ from a volume limited one. The results are summarized in this Figure. Surprisingly, the overall $v \sin i$ distribution is almost exactly the same in the SMC (mean metallicity $Z \sim 0.008$) and in the LMC ($Z \sim 0.004$). There is only a marginal difference between h & χ Per ($Z(\text{h Per}) \sim 0.01$ according to [8]) and the MCs, but a very significant one ($P < 0.1 \%$) between the Galactic field ($Z \sim Z_{\odot} = 0.018$) and the MC fields. Thus, either the metallicity effect saturates for $Z < Z(\text{LMC}) \sim 0.008$, or another cause affects rotational velocities, e.g. different rates and orbital parameters of SB1 binaries (not excluded from the samples), through tidal effects.