Stellar Rotation
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A Calibration of FWHM vs. v for UV Lines

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Abstract. The UV spectra predicted by LTE line-blanketed model atmosphere calculations are used to obtain a preliminary calibration of *FWHM vs.* v for UV lines, which is then used to determine the values of $v \sin i$ for four O-type stars in the Small Magellanic Cloud.

The $\lambda\lambda$ 1150-1700 Å wavelength region contains a wealth of photospheric absorption lines from a wide range of ionization potentials. Until recently, these UV lines had not been accurately reproduced by stellar atmosphere model calculations, and thus the standard method used to calibrate linewidth as a function of $v \sin i$ by comparing observations with rotationally broadened models had not been applied to this wavelength region.

Koenigsberger et al. (2002) compare the UV spectra of four O-type stars in the Small Magellanic Cloud with the theoretical spectra computed from LTE line-blanketed model atmospheres, and show that the models reproduce the line profiles in a very satisfactory manner. The four SMC stars are listed in Table 1, and are numbered according to the catalogue of Massey, Parker & Garmany (1989). Columns 2 and 3 of Table 1 list the spectral type, according to Massey et al. (1989) and to Walborn et al. (2000), respectively; column 4 gives the projected rotational velocity that we derive with the procedure that will be described below; and column 5 gives an estimate of the wind velocity as measured from the C IV 1550 P Cygni absorption edge.

Using the theoretical spectra for values of v in the range 25-125 km s^{-1}, we search for lines that are suitable for unambiguous measurement of width, and measure the *FWHM* of the Gaussian fit to the line profile. When two or more lines are blended together, these are de-blended by fitting multiple Gaussians. The results, for two effective temperatures (40000 and 52500 K) are plotted in Fig. 1, where open triangles correspond to λ 1343 (O IV), squares to λ1376 (Fe V), and filled-in triangles to λ1411 (Fe V). The widths of these same lines were measured on the spectra of the SMC stars and two of these are plotted on the bottom panel of Fig. 1 with the large symbols (the points for the third line overlap with the points for the other two). Consistent values for $v \sin i$ are derived from the different lines, except in the case of MPG 355, where the O IV line yields a much larger line width than the other lines. This is a consequence of the larger mass-loss rate in MPG 355, and thus illustrates that the determination of accurate values of $v \sin i$ requires the use of lines that are not strongly contaminated by absorption in the expanding layers of the the photosphere.

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MPG	Massey et al.	Walborn et al.	$v \sin i$	V_{edge}
355	O3V((f*))	ON3III(f*)	75:	3200
324	O4V((f))	O4V((f))	64	2500
368	O5.5V((f^+))	O4-5V((f))	60	2300
113	O6V	OC6Vz	35	–

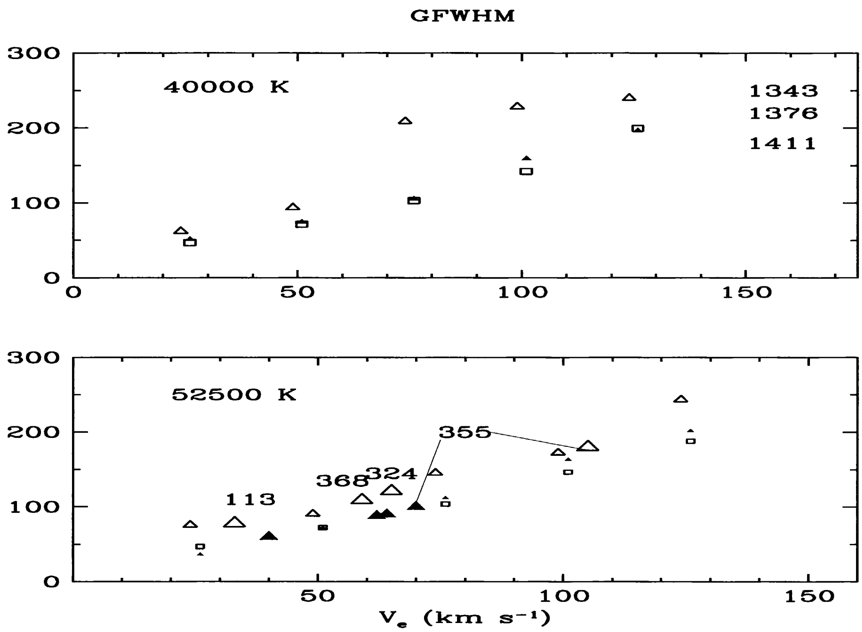

Figure 1. Calibration of Gaussian FWHM *vs.* v from model spectra (small symbols) and results for the 4 SMC stars. The discrepant values for MPG 355 are a result of its strong stellar wind.

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