ABSOLUTE MAGNITUDES OF WOLF-RAYET STARS: THE WN3 AND WN4 SUB-CLASSES IN THE LARGE MAGELLANIC CLOUD

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After the systematic survey carried out by Azzopardi and Breysacher (1979, 1980) at La Silla, Chile, with the 40-cm Objective Prism Astrograph, the census of the Wolf-Rayet population (101 stars) in the Large Magellanic Cloud (LMC) can probably be considered as quite complete except, perhaps, for stars located in the core of dense HII regions. The catalogue by Breysacher (1981) includes 100 stars to which one has to add one star of the WN type discovered by Sanduleak (private communication) outside of the survey limits.

The absolute magnitude calibration for WR stars derived by Smith (1968) was based, for the WN3 and WN4 sub-classes, on 2 and 5 stars respectively. At present, the corresponding figures are 22 and 12 stars because the newly detected WR stars in the LMC mainly belong to the early WN types. With such an increase in the number of stars in our sample it seemed to us worthwhile to reinvestigate the luminosity calibration for the WN3 and WN4 type stars.

In the present study the absolute magnitudes were derived using the V photographic magnitudes determined by Rousseau et al. (1978) for the previously known LMC WR stars and by Azzopardi and Breysacher (1979, 1980) for the stars discovered more recently. In both cases the magnitudes were obtained from astrographic plates taken after removing the prisms of the Objective Prism Astrograph, thus providing us with an homogeneous set of data. According to the location of the WR stars, the magnitudes were corrected for reddening using the

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E_{B-V} values given by Brunet (1975) for the different regions of the LMC. An extinction ratio $R = A_V/E_{B-V} = 3.2$ was adopted (Olson, 1975). We carefully examined the distribution of the WR stars compared to that of the LMC dark nebulae (Hodge 1972; van den Bergh, 1974) taking note of their distance from the strongly reddened LMC stars listed by Isserstedt (1975) in order to ensure that the faintness of some of the WR stars was not due to a peculiar local high absorption. The absolute magnitudes were calculated assuming an absorption-free distance modulus of 18.5 for the LMC (Westerlund, 1974). The two histograms presented in Fig. 1 illustrate the results. In Table 1, the present values of the mean absolute magnitudes are compared to those derived by Smith (1968) who used an LMC distance modulus of 18.7.

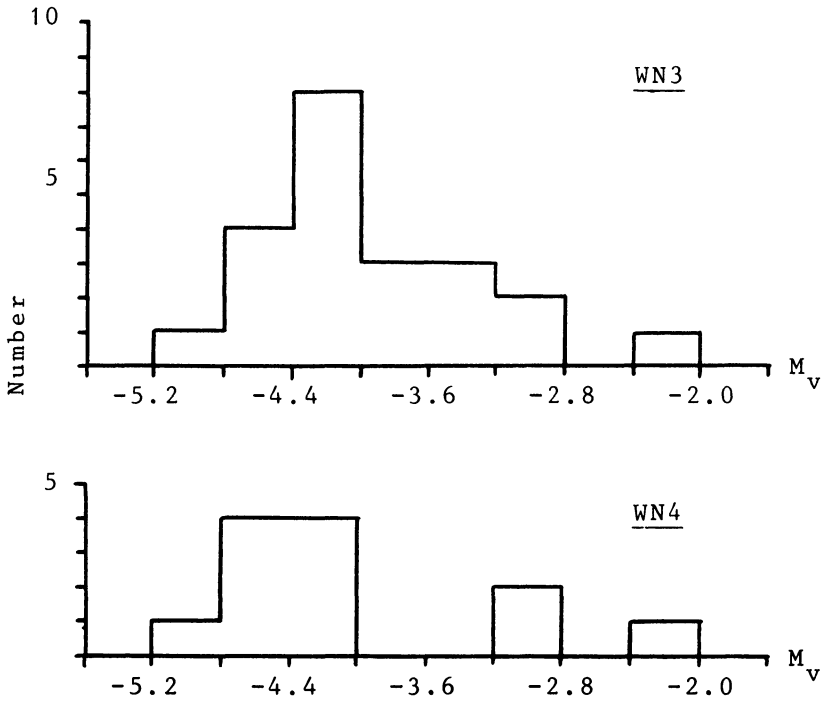

Figure 1. Histograms of the absolute magnitudes for LMC Wolf-Rayet stars.

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Table 1. Mean visual absolute magnitudes of Wolf-Rayet stars

Class	Smith			Present		
	M_V	n	σ*	M_V	n	σ*
WN3	-4.5	2	±0.1	-3.9	22	±0.6
WN4	-3.9	5	±0.3	-4.0	12	±0.8

* Standard deviation of a single star

The increase in size of the samples has resulted in an increase of the magnitude dispersion. The distribution of the absolute magnitudes found here for WR stars is quite comparable to the one derived by Stothers (1972) for galactic OB supergiants. However, the number of stars considered is still too small to provide very statistically significant results.

To conclude we would like to mention a spectral peculiarity of the brightest WN4 star of Fig. 1 (No. 29 in Breysacher catalogue). This is the presence of a strong λ5806 CIV emission line which is very unusual for a WN star whose spectrum, apart from this feature, is entirely normal for its type. Possibly this WR star lies in the category of the so-called "transition objects".

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DISCUSSION FOLLOWING BREYSACHER AND AZZOPARDI

Moffat: The σ's for WN3 and WN4 stars appear to be quite normal compared, say, to the dispersion among O-stars (for a given MK class). Thus we need not worry about the "tails" of the distribution of luminosities, e.g. $M_V \simeq -2$.

Niemela: Did you find any difference between the absolute magnitudes of stars belonging to clusters and those which do not?

Breysacher: For the WR stars belonging to the WN3 and WN4 subclasses there seems to be no significant difference.

Massey: If there were WR stars with $M_V = -1$ in the LMC or SMC, would you have found them?

Breysacher: In the survey we have reached the continuum of stars of mag. 17.5. With a distance modulus of 18.5 for the LMC, WR stars with $M_V = -1$ should, in principle, have been detected. However, this is at the limit.

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