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Erratum: Spatial distribution of Galactic Wolf–Rayet stars and implications for the global population

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The paper 'Spatial distribution of Galactic Wolf–Rayet stars and implications for the global population' was published in MNRAS, 447 (1), 2322 (2015).

An error has been discovered in the calculation of extinction in the K_S band (A_{K_S}) towards model Wolf–Rayet (WR) stars, in the model population presented in section 4 of the paper. Specifically, integration of the function describing the Galactic dust distribution (equation 13) was being performed using an incorrect coordinate to locate each model WR star. This had the effect of generating some anomalously high values of A_{K_S}, hence predicting apparent magnitude distributions for the WR population extending to exceedingly faint magnitudes ($K_S > 17$).

This mistake has been rectified, and new model populations have been generated and compared to observations to acquire new predictions regarding the total population (as described in section 4.3). Revised extinction values result in a general brightening of predicted populations, meaning models with fewer stars are capable of reproducing the distribution of K_S magnitudes in the magnitude-limited sample (section 4.3.1). We show this in an updated Fig. 11. Following an identical method to that in section 4.3.2, the population inferred from Fig. 11 is added to by considering fractions of neglected WR types, derived from a volume-limited sample. The new estimated total population of Galactic WR stars is 1200 ± 200, down from 1900 ± 300. Following the star formation arguments in section 4.4, this decreased population implies a reduced average WR phase duration, from 0.4 to 0.25 Myr. This phase duration is in better agreement with evolutionary models for non-rotating single stars (Georgy et al. 2012), but further below those for rotating single stars and binary stars (Eldridge, Izzard & Tout 2008; Georgy et al. 2012).

The revised apparent magnitude distributions have severe implications for our predicted 95 per cent completeness limit in the K_S band. We include an updated Fig. 12, showing revised apparent magnitude distributions in J, H, K_S and G (*Gaia*) bands. Extinction in all bands were previously derived from erroneous A_{K_S} calculations. From this, we now predict that to achieve 95 per cent completeness in the WR population, follow-up spectroscopy to $K_S \lesssim 13$ mag will be necessary. In contrast to our previous estimate of $K_S \lesssim 17.5$, this is 2.5 mag *brighter* than the estimate of Shara et al. (2009). Our predictions regarding the potential of ESA *Gaia* are also affected but our conclusions remain unchanged. We now predict that ~300 (increased from ~250) WR stars will be sufficiently bright for *Gaia* spectroscopy, still yielding few WR star discoveries.

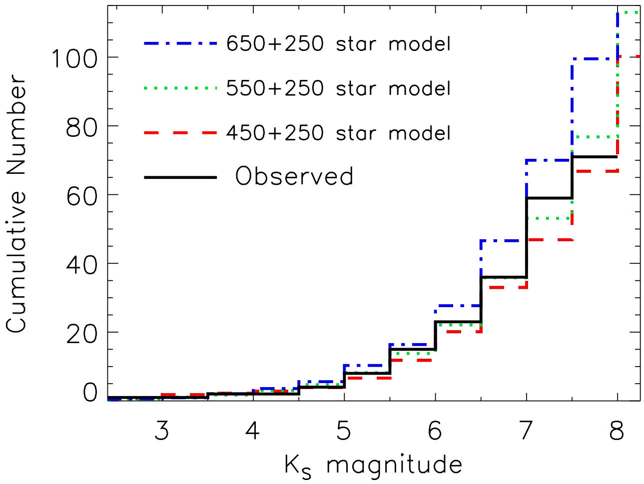

Figure 11. The cumulative number of observed WR-dominated systems (black solid line) in bins of 0.5 K_S mag, compared with that of three different model WR populations, incorporating corrected A_{K_S} calculations as discussed in text.

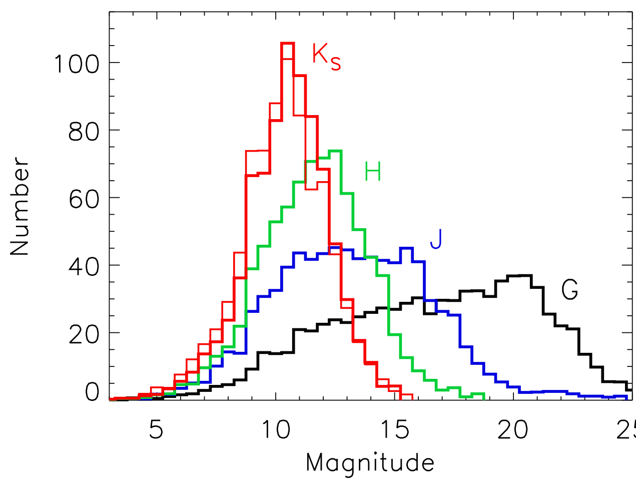

Figure 12. Histogram of predicted 2MASS JHK_S and G-band (*Gaia*) magnitudes for the preferred model Galactic WR star population, using corrected extinction calculations. Each distribution shown is an average over 10 model repetitions. Two K_S-band distributions are plotted, the thin (red) line represents a model population where 28 per cent of WC stars are dust forming (WC8d/9d, $M_{K_S} = -6.95$, table 5). All thick lines represent populations consisting of WN and non-dusty WC stars only.

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