A census of the Wolf-Rayet content in Westerlund 1 from near-infrared imaging and spectroscopy

Paul A Crowther (1), L J Hadfield (1), J S Clark (2), I Negueruela (3), W D Vacca (4)

1: Sheffield; 2: Open Univ; 3: Alicante; 4: NASA Ames

New NTT/SOFI imaging and spectroscopy of the Wolf-Rayet population in Westerlund 1 are presented. Narrow-band near-IR imaging together with follow up spectroscopy reveals four new WR stars, of which three were independently identified recently by Groh et al., bringing the confirmed WR content to 24 (23 excluding source S) [..] A quantitative near-IR spectral classification scheme for WR stars is presented and applied to members of Westerlund 1. Late subtypes are dominant, with no subtypes earlier than WN5 or WC8 for the nitrogen and
carbon sequences, respectively. A qualitative inspection of the WN stars suggests that most (75%) are highly H-deficient. The WR binary fraction is high (>62%), on the basis of dust emission from WC stars, in addition to a significant WN binary fraction from hard X-ray detections according to Clark et al. We exploit the large WN population of Westerlund 1 to reassess its distance (~5.0kpc) and extinction (A_Ks ~ 0.96 mag), such that it is located at the edge of the Galactic bar, [..]. The observed ratio of WR stars to red and yellow hypergiants, N(WR)/N(RSG+YHG)~3, favours an age of 4.5-5.0 Myr, with individual WR stars descended from progenitors of initial mass ~ 40-55 Msun. Qualitative estimates of current masses for non-dusty, H-free WR stars are presented, revealing 10-18 Msun, such that ~75% of the initial stellar mass has been removed via stellar winds or close binary evolution. We present a revision to the cluster turn-off mass for other Milky Way clusters in which WR stars are known, based upon the latest temperature calibration for OB stars. Finally, comparisons between the observed WR population and subtype distribution in Westerlund 1 and instantaneous burst evolutionary synthesis models are presented.

Reference: 20 pages, 11 figures accepted for MNRAS
Status: Manuscript has been accepted

Weblink: http://arxiv.org/abs/astro-ph/0608356

Comments:

Email: Paul.crowther@sheffield.ac.uk