The Search for Wolf-Rayet Stars in IC10

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Abstract. We present a deep imaging and spectroscopic survey of the Local Group starburst galaxy IC10 using Gemini North/GMOS to unveil the global Wolf-Rayet population. It has previously been suggested that for IC10 to follow the WC/WN versus metallicity dependence seen in other Local Group galaxies, a large WN population must remain undiscovered. Our search revealed 3 new WN stars, and 5 candidates awaiting confirmation, providing little evidence to support this claim. We also compute an updated nebular derived metallicity of log(O/H)+12=8.40 ± 0.04 for the galaxy using the direct method. Inspection of IC10 WR average line luminosities show these stars are more similar to their LMC, rather than SMC counterparts.

Keywords. stars: Wolf-Rayet, galaxies: individual (IC10), ISM: abundances

The Local Group dwarf galaxy IC10, located at a distance of 740kpc, is host to an unusual population of Wolf-Rayet (WR) stars, which are massive stars progressing through the end stages of evolution. Previous WR surveys have identified 26 WR stars, corresponding to an unusually high spectral type ratio of WC/WN=1.3, in view of the low metallicity environment of IC10 (Crowther *et al.* 2003). One explanation suggested these prior surveys are incomplete for WN stars (Massey & Holmes 2002), therefore prompting the deep imaging and spectroscopy presented here.

Using narrow HeII and continuum filters with Gemini North/GMOS, image subtraction techniques were used to reveal HeII excess sources, a robust marker for WR stars. This search yielded 9 WR candidates, and follow up spectroscopy on 4 of these targets successfully confirmed 3 new WN stars. One of these stars, associated with the HII region HL45, provided a clear measurement of the [OIII] λ4363 nebular emission line, allowing an updated oxygen abundance to be obtained. Prior metallicity measurements recorded a value of log(O/H)+12≈8.26 (Garnett 1990), however our analysis suggests a higher value of log(O/H)+12=8.40 ± 0.04.

The WR star total in IC10 has now been raised to 29, with an updated WC/WN ratio of 1. With deep imaging revealing a further 5 WR candidates, we are confident a huge hidden population of WR stars does not exist. The sensitivity limit of this survey is $M_{HeIIC}=$ −2.4 mag (for A_{HeIIC}=3.4 mag) which should be sufficient to identify these stars, even those which may fall into the recently proposed new WR class of characteristically faint WR stars (Massey *et al.* 2014). Average HeII λ4686 and CIV λ5808 line luminosities for WN and WC stars respectively are comparable to those of LMC WR stars and therefore consistent with the new higher metallicity measurement obtained.

References

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