Wolf-Rayet Phenomena in Massive Stars and Starburst Galaxies
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Stellar properties of Galactic Centre He I sources

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1. Introduction

The Galactic Centre (GC) region has in recent years attracted a lot of attention from the hot star community following the discovery of numerous He I emission line sources (Krabbe *et al.* 1991). Recent studies (*e.g.*, Najarro *et al.* 1994) revealed stellar properties reminiscent of cool Wolf-Rayet stars, providing clues to the origin of the Lyman and He^+ ionizing fluxes, and the luminosity in the central parsec of our galaxy. They allow the recent star formation history to be unveiled, and assess the effect of high metallicity on massive star evolution.

2. Stellar properties of hot stars from IR diagnostics

Observationally, the GC suffers extremely high extinction, so that exclusively IR diagnostics can be used to derive stellar properties. Crowther & Smith (1996) and Bohannan & Crowther (1999) have previously investigated the properties of WR and Of stars, based exclusively on IR observations. They found that derived parameters are fairly consistent with UV/optical studies provided that suitable diagnostics are used, namely H I, He I-II lines for WN stars, with care needed for some lines (*e.g.*, 2.058 μm is very sensitive to line-blanketing).

Unfortunately, the most suitable He II lines are either too heavily reddened (1.012 μm), or too weak (2.189 μm) in GC sources. Without a He II diagnostic, analyses to date (*e.g.*, Najarro *et al.* 1994) have suffered from substantial uncertainties in stellar temperatures, and consequently ionizing fluxes, mass-loss rates and elemental abundances. We have circumvented this problem by using *UKIRT*-CGS4 to observe GC He I sources in the thermal IR, covering the strong He II 3.09 μm line. During 1998 July, we collected spectra of several GC stars, of which solely the AF star, the Quintuplet star qF#240 (Figer *et al.* 1999), and the Arches star #11 (Cotera *et al.* 1996) show He II 3.09 μm emission. Selected He II line profiles of comparison stars are shown in Figure 1.

We used the non-LTE model for extended atmospheres of Hillier (1990) to determine the stellar parameters of the GC sources, based on He I 1.70μm, He II 3.09 μm and Brγ. Premliminary results are $T_* \simeq 30$ kK for each star, with $\log(L/L_\odot) = 6.0 \pm 0.3$, $\log(\dot{M}/M_\odot yr^{-1}) \simeq -4.3$, and H/He $\simeq 4$, by number. Interstellar extinctions were in the range $E_{B-V} = 8.2 \pm 0.5$ mag. For the AF star, the contrast with the previous study of Najarro *et al.* (1994) is striking. Na-

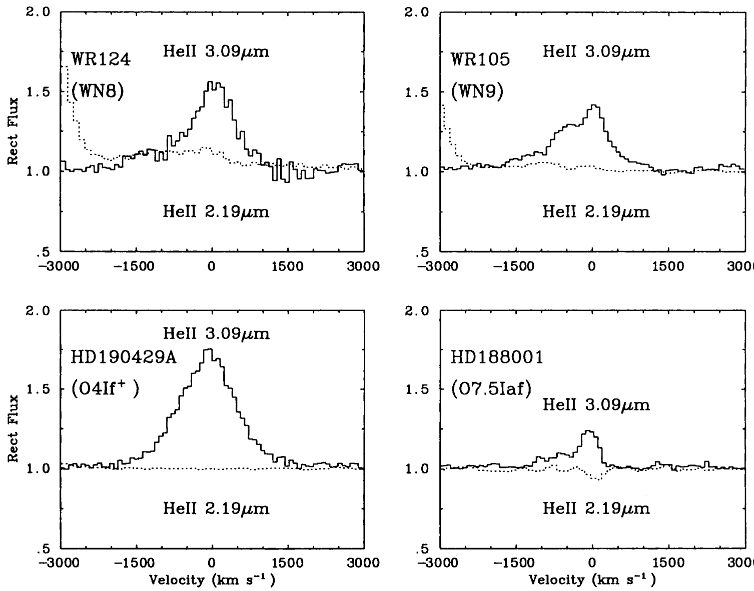

Figure 1. Comparison between *UKIRT* observations of He II lines at 3.09 μm (solid) and 2.189 μm (dotted) in Galactic WNL and Of stars.

jarro *et al.* obtained $T_* = 19$ kK and H/He = 0.6 by number, using an identical method except that He II was unavailable. One effect of our higher temperature is to deduce a He^+ ionizing flux which is a billion times higher than Najarro *et al.* Clearly, the detection of He II is extremely important for the determination of reliable stellar parameters in heavily reddened hot stars.

Finally, the K and L-bands do not readily provide accurate spectral classifications for Of and WNL stars. For strong emission line stars, it is essential that He II emission lines are observed so that WNL spectral classifications may be given. Otherwise, extreme B-supergiants, such as P Cyg or HDE 316285 (Hillier *et al.*, these Proceedings) may inadvertantly be mis-classified as WN stars, since they share many IR spectroscopic features, such as strong He I 2.058μm emission.

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