The Lives and Death-Throes of Massive Stars
Proceedings IAU Symposium No. 329, 2016
J.J. Eldridge, J.C. Bray, L.A.S. McClelland & L. Xiao, eds.

doi:10.1017/S174392131700357X

WR 148 and the not so compact companion

Melissa Munoz[1], Anthony J. Moffat[1], Grant M. Hill[2], Tomer Shenar[3], Noel D. Richardson[4], Herbert Pablo1[3], Nicole St-Louis[1] and Tahina Ramiaramanantsoa[1]

[1]Université de Montréal, [2]W. M. Keck Observatory, [3]Institut fürr Physik und Astronomie, [4]University of Toledo

Abstract. The objective is to determine the nature of the unseen companion of the single-lined spectroscopic binary, WR 148 (= WN7h+?). The absence of companion lines supports a compact companion (cc) scenario. The lack of hard X-rays favours a non-compact companion scenario. Is WR 148 a commonplace WR+OB binary or a rare WR+cc binary?

Keywords. binaries: spectroscopic, stars: Wolf-Rayet , stars: individual (WR 148).

WR 148 (WN7h) is a single-lined spectroscopic binary with an established period of 4.3174 d suspected to harbour either a low mass B star or a black hole companion (Marchenko *et al.* 1996). We obtained two nights of spectra from the Keck Observatory at both quadratures complemented by additional other spectra from l'Observatoire du Mont-Mgantic (OMM) in the summers of 2014 and 2015.

The high resolution and high signal-to-noise ratio Keck spectra reveal absorption lines moving in anti-phase to the WR emission lines with similar velocity amplitude (see Table 1 for the orbital elements). Considering an orbital inclination of $\sim 67°$, derived from previous polarimetry observations (Drissen *et al.* 1986), the systems total mass would be a mere 2-3 $M_{\odot}$; an unprecedented result for suspected massive binary.

Table 1. Orbital solution for the WR star and companion.

Object	P [days]	E [HJD - 2,440,000]	γ [kms s^{-}1]	K [kms s^{-}1]
WR star	4.317336 ± 0.000026	4825.04 ± 0.03	88.1 ± 3.8	-131.4 ± 2.7
Companion			79.2 ± 3.1	-120.1 ± 1.2

We apply the shift-and-add technique to disentangle the spectra and obtain a companion spectrum compatible with an O5 spectral type. Assuming a typical mass for a O5 V type from Martins *et al.* 2003, we obtain a new orbital inclination of $\sim 20°$. This discrepancy in inclination angle can be reconciled with a revised error assessment on the polarisation data. In fact, Wolinski & Dolan (1994) demonstrate that polarimetrically-derived inclination angles have a statistical bias towards higher angles.

To summarise, WR 148 is found to be a normal, massive, close WN7+O5 binary system. Though not discussed here, evidence of colliding winds has been discovered as well as thermal X-rays compatible with other WR+O colliding wind binaries.

References

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