# The Massive Stars in the H II Region NGC 595

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## 1. An Unexpected Far-UV Spectral Synthesis

(See details by Pellerin 2006, AJ, in press [astro-ph/0510686])

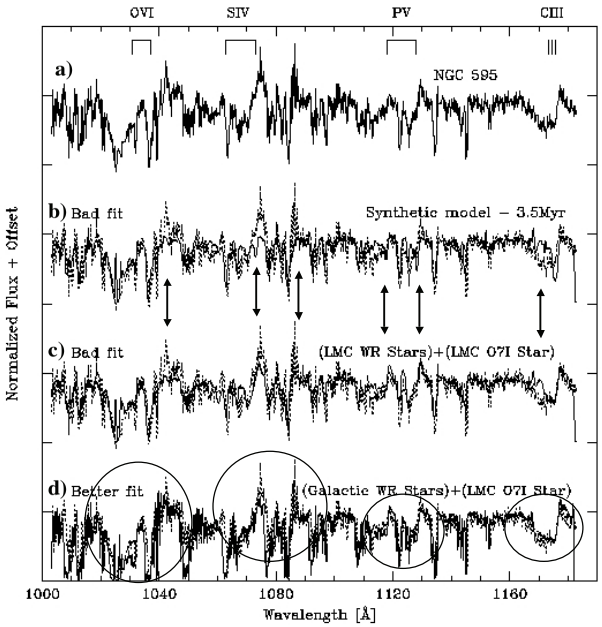



**Fig.1: Far-UV Spectral Synthesis of NGC 595. For spectrograms b, c, and d: • FUSE spectrogram …….. • Fit: _____**

**Spectrum of Figure 1:**

a) **A good quality spectrogram of NGC 595 ($0.4Z_\odot$ ~ LMC metallicity) was obtained with FUSE. Unusually strong P Cygni profiles are observed in the stellar lines of OVI λλ1032, 1038, SiV λλ1063, 1073, PV λλ1118, 1128 and CIII λ1176**

b) **Spectral synthesis models with LavalSB in the Far-UV failed to reproduce the broad wind profiles of the CIII and PV lines observed with FUSE.**

c) **A close match is a single O7 supergiant LMC star, probably the main contributing type in the Far-UV flux, but it is not yet a good fit. The archival HST/WFPC2 images indicates that 30% of the UV flux is produced by WR stars. The combination of a O7 I star (70% in flux) and WN7-type stars (30%, see §2) from the LMC (i.e. having the proper metallicity for NGC 595) gives a better fit, but it is not yet satisfying.**

d) **Surprisingly, the combination of an LMC O7 I star (70%) with a Galactic WR star (30%) gives a very good fit. However, the metallicity of the WR stars does not correspond to NGC595 anymore.**

## 2. Spectral Classification of the WR Stars

(Based on Drissen et al. 2006, in preparation)

**Recent data of the WR-bump obtained at the Canada-France-Hawaii Telescope (CFHT) allowed, for the first time, a detailed spectral classification of most WR stars within NGC 595 (see examples in Fig. 3). Based on the HST/WFPC2 UV image, 5 WR stars contribute to the FUSE spectrogram, which are classified here as one WN6/7 and four WN7/8 stars.**

**However, even using this reliable spectral classification from the visible range, we found an inconsistent results with the FUSE data, (see Fig. 1c). Far-UV synthesis revealed that the spectra of a Galactic WN 9 was more appropriate to explain the very pronounced wind profiles for the OVI, SiV, PV, and CIII stellar lines (see Fig. 1d).**

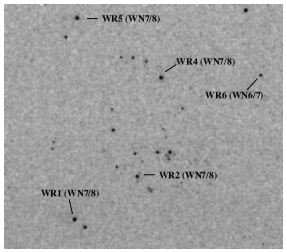
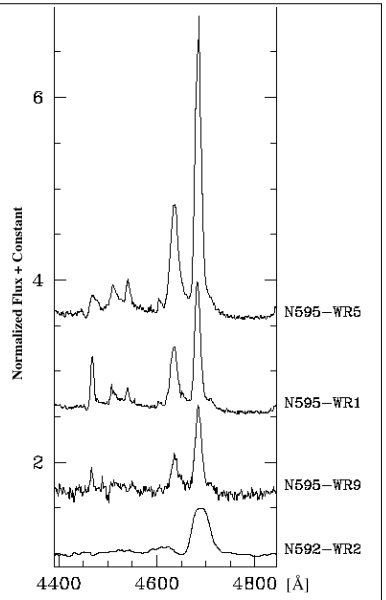



**Fig.2: HST/WFPC2 (F170W filter) archival image of NGC 595. WR stars are identified with their spectral classes.**

**Fig.3: CFHT Spectrograms of WR stars in NGC 595. WR1 and WR5 are classified as WN 7/8 and contribute significantly to the UV flux of NGC 595.**




## 3. Why can Galactic WR stars reproduce the Far-UV stellar lines of NGC 595 while LMC WR stars cannot?

**A research into the FUSE data archive revealed significant differences in the stellar line profiles of WR stars having the same spectral type (e.g. WN6 type, see Fig. 4), which are not obvious in the visible range. However, the limited number of WR stars with the same spectral type do not allow yet to fully study the origin of these spectral variations. It can be due to a fine stellar evolutionary stage, or to an unknown binary companion.**

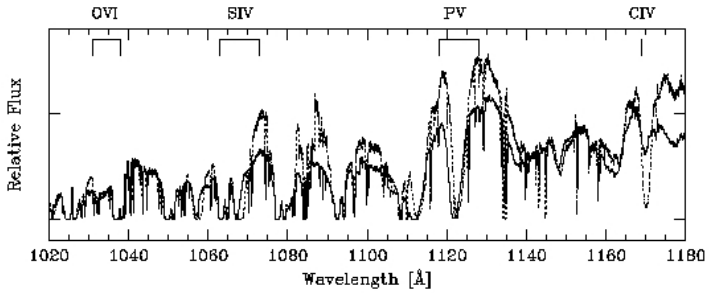



**Fig.4: FUSE spectrograms of two Galactic WN6 stars. Dotted line: HD 192163; Plain line: HD 191765. These two stars have no known binary companion.**

## Main Conclusions:

- **NGC 595 is enhanced with WR stars. They contribute to a large fraction (30%) of the UV flux.**
- **O7 I stars are the main contributor to the Far-UV flux and dominate the line profiles of OVI, SiV, PV, and CIII .**
- **Far-UV Spectra of WR stars are significantly different within a same subtype, a phenomenon at visible wavelengths.**
- **More FUSE data are needed to better understand the spectral differences observed in the Far-UV.**
- **More data are needed to investigate on the possibility of binary systems.**