

Crescent Nebula and the stellar spectrum of WR 136

The Crescent Nebula (NGC 6888) is an emission nebula in the constellation Cygnus, about 5000 light-years away from Earth.

It is formed by the fast and powerful stellar wind from the hot, central Wolf-Rayet star colliding with and energizing the slower moving wind ejected by the star when it became a red giant around 250,000 to 400,000 years ago. The result of the collision is a shell and two shock waves, one moving outward and one moving inward.

This HOO-image of the Crescent Nebula is acquired with the Officina Stellare 700RC telescope (SPA-2) in IC Astronomy Observatory, Spain. Data from a Pro Dataset curated by Ian Howarth, and one-click observations were combined. Only H-alpha and OIII data was used in this image, since there is very little SII emission (Ha and OIII mapped to RGB as HOO).

The nebula is highly ionized by the radiation of the central Wolf-Rayet (WR) star. WR 136 (HD 192163) is a so-called WN6 spectral-type star (N from nitrogen, hence with nitrogen emission lines in the spectrum). More info on classification of WR-stars can be found in https://en.wikipedia.org/wiki/Wolf%E2%80%93Rayet_star

The astrophotography & spectroscopy group of the "Public Observatory A Pien" in Ghent, Belgium (where I'm a member of) is also dealing with stellar spectroscopy.

Hugo Van den Broeck is an experienced "spectroscopist" in our group, involved in several spectroscopy-related ProAm-projects. Hugo did a spectral characterization of WR 136 (together with Guy Wouters, Hugo Van Eeckhout), using the infrastructure of the department of Physics and Astronomy of the University of Ghent: 16" Cassegrain, ATIK 460EX camera and Alpy 600 spectroscope.

(<https://observatory.ugent.be/observatory/index.html>)

The second figure below shows the spectrum of WR 136, together with the synthetic color band of the emission spectrum. Data reduction with BaSS-project software.

Ionized helium emission lines (He II) are abundant in the spectrum of WR 136. Multiple ionized nitrogen emission lines N III, N IV and N V are also found.

(FYI: N III is 2 x ionized, N IV 3 times and N V 4 times. N I is neutral nitrogen)

Criteria for a WN6 star are: $1.25 < \text{He II}/\text{He I} < 8$, $0.2 < \text{N V}/\text{N III} < 0.5$