

HI BUBBLES AROUND NGC 6888

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1. Introduction

The interstellar bubbles are generally the result of the interaction of strong stellar winds with the surrounding material. HI voids and shells have been disclosed around several WR stars in our Galaxy (*e.g.* Niemela & Cappa de Nicolau 1991, Dubner *et al.* 1992). We report here an analysis of the interstellar medium in the vicinity of the WR star HD 192163 = WR 136 and the optical ring nebula NGC 6888 based on HI observations. Our aim is to look for the traces left in the cold interstellar gas by the action of the stellar winds of HD 192163.

2. Observations

To investigate the neutral hydrogen distribution and kinematics in the surroundings of NGC 6888 we surveyed a $2.^{\circ}1$ field around the nebula. The observations were carried out in July 1992, using the Synthesis Telescope of the Dominion Radio Astrophysical Observatory (DRAO) placed near Penticton, British Columbia, Canada.

3. Main Results

A detailed analysis of the neutral hydrogen distribution at low positive velocities, compatible with the optical distance of HD 192163, and the comparison with optical and infrared emissions allowed us to identify three different HI structures with a hierarchical organization surrounding the WN6 star and its ring nebula. From inside to outside they are:

a) An inner shell: A small and elliptical almost complete HI shell is clearly seen embracing NGC 6888. The feature is detected in the velocity range $+3$ to $+20$ km s⁻¹ and presents a complex velocity field. The shell, centred close to the position of the star, is 13×7 pc in size adopting a distance of 1.5 kpc for the WR star (Conti & Vacca 1990). The HI mass in the shell amounts to $\approx 200 M_{\odot}$. The coincidence between the brightest parts of NGC 6888 and the borders of the HI emission distribution strongly suggests that the nebula is interacting with the surrounding interstellar material.

b) An outer shell: This structure, also detected in infrared emission, is best seen at $+16.6$ km s⁻¹. It is 30 pc in diameter at a distance of 1.5 kpc. Emission related to the shell can be detected in the velocity interval $+3$ to $+20$ km s⁻¹. The HI mass in the envelope amounts to $\approx 960 M_{\odot}$. The presence of this shell in the same velocity range as the inner shell and the fact that it is centred near the position of HD 192163 lead us to the hypothesis that some relationship there exists between them.

c) An external shell: It appears as the neutral gas counterpart of the large IR shell described by Nichols–Bohlin & Fesen (1993) with a diameter of 40×47 pc. The present observational results suggest a *scenario* where the material that conforms both the inner and the outer shells was pushed out by the strong stellar wind of the WR star, expanding in an inhomogeneous interstellar medium. About 4×10^4 yr ago (Treffers & Chu 1982), the material ejected by the star originated the optical nebula. The ionized gas encountered higher density regions belonging to the outer neutral bubble and shaped the inner neutral bubble in this gas. The role of the external shell is an open question. The absence of any detectable expansion suggests that it is older than the outer shell. It might be a fossil bubble.

References

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