Wolf-Rayet Phenomena in Massive Stars and Starburst Galaxies
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Initial conditions in the evolution of OB and Wolf-Rayet stars in N 105 of the LMC

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Abstract. The detailed radial velocity field of the H II region N 105, in the LMC, has been obtained for the Hα and [OIII] 5007 lines with a spatial sampling of 9″ and a spectral sampling of 16 and 7 km s^{-1}. The peculiar velocity field and morphology indicate that N 105 contains four bubble shaped nebulae and two bright distinct quasi-spherical H II regions, more or less coeval, embedded inside another large shell nebula. They are essentially formed by the action of stellar winds of a few exciting stars, born deep inside their parental cloud. This result is deduced from the energy input inside the ionized gas by the stellar winds of early type stars and from dynamical simulations combining the effects of stellar winds with those of high density gradients inside the neutral gas. The size and morphology of the H II region are conditioned by the depth inside the natal cloud; the observed dynamical time-scale of the H II region starts at the moment of blow-out of the molecular cloud.

1. Discussion

We have made a kinematics study of the four nebulae forming N 105 and we have found that none of the bubbles N 105W, SW, NW and NE can be explained only as stellar wind driven bubbles of *in-situ* stars, inside an homogeneous ambient medium. The most likely origin of the bubbles N 105W, SW, NW and perhaps also NE, is a combined effect of the stellar winds with a negative density gradient medium. The location of the stars Br 16, Br 16a, and Br 61 (off-centered in their bubbles and close to the observed molecular cloud, see Chin *et al.* 1997) supports such a nature of blisters of the nebulae.

We present a simulation of the evolution of the velocity for the gas surrounding an O9V star located 1.5 Strömgren-radii from the cloud boundary ($n_{\rm H} = 10^4$ cm^{-3}), with stellar parameters $T_{\rm eff} = 36000$ K, $\log N_{\rm Lym} = 48.56$ and $\dot{M} = 3 \times 10^{-7}$ M$_\odot$ yr^{-1}. The frame corresponds to an evolution time 3.25×10^5 yr and the computational grid is 14.3 pc. In this simulation we find on each side of the largest expansion velocity, lower turbulent motions developing inside several shells; nevertheless, such motions can appear to the observer as originating from different entities. Such a pattern reasonably matches the western part of N 105; in this case the main sequence precursor of the WR star Br 16 could have been the single energy source for all bubbles of the western side. The MS star

was probably embedded deep inside the parental cloud, which would explain the age of the star (4–5 Myr before arriving at the WR phase) for such a recent dynamical time scale evolution stage of the H II region (a few 10^5yr).

Another possible scenario is that the injector of energy in the structure was not a single star; perhaps all these bubbles were formed by a few OB stars seen in the bubbles, which should have been located near the boundary of their parental cloud. Since their stellar winds are not extremely strong, density gradients should have allowed the gas velocity to grow and the wind-driven bubbles to expand.

References

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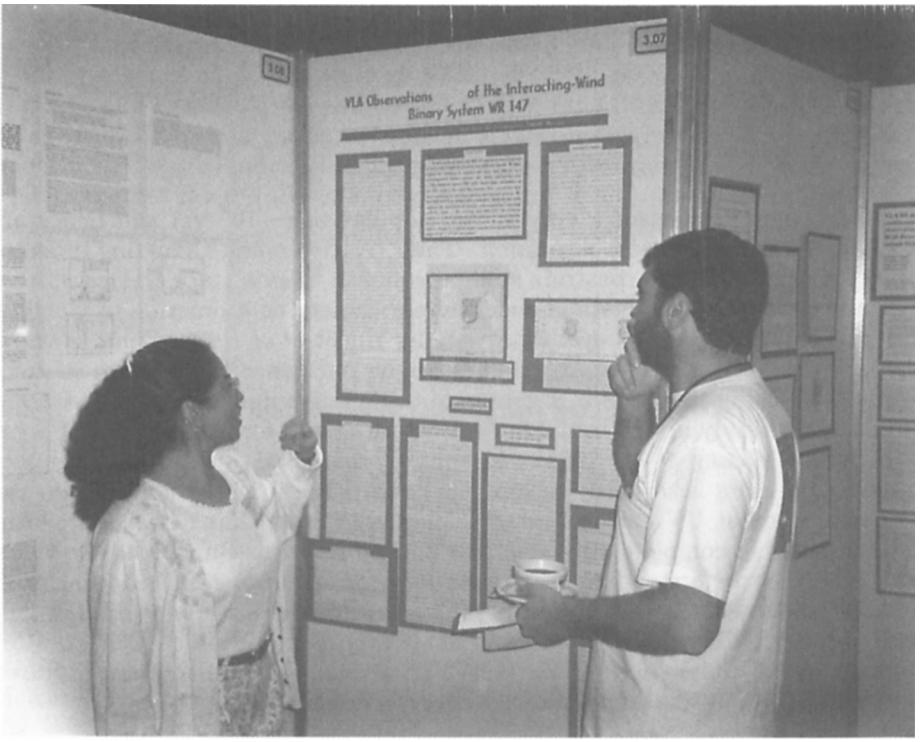

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