STOCHASTIC STARFORMATION AND BUBBLES IN THE LARGE MAGELLANIC CLOUD

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Nearly all places in the LMC where ring nebulae or shell structures in the neutral or ionized interstellar medium are observed, an OB association and/or WR-stars can be located (Braunsfurth, Feitzinger, 1983). Several mechanisms have been propsoed to generate shell or bubble structures: stellar winds, supernovae explosions, evolving HII regions, sequential starformation, collapsing hydrogen clouds interacting with stellar winds and radiation pressure. Ordered motions resulting in a shell or bubble structure are the result of almost any point like energy injection into the interstellar medium. Therefore all the mechanisms result in similar morphological structures, thus similar shapes can have heterogeneous origins.

For the diameter evolution we might expect time to be the dominating evolution parameter. However the large scatter of diameters of emission regions at a given age indicates that this is not so (Fig. 1a, b). It is evident from these figures that the other parameters: e.g. mechanical wind power, ionizing flux, initial energy of the objects and the mean density of the surrounding medium are the main factors determing the shape of the HII regions. Wind power ($\dot{E}_W$) and density (N_O) have opposite effects and are presented as one parameter $\dot{E}_W/N_O$. From the diameter age diagrams we conclude that this parameter covers 4 orders of magnitude and is a primary factor for the diameters of emission regions. Only the initial conditions determine the positions of the emission regions in the diameter age diagram.

Feitzinger et al. (1981) discussed the bubble formation process as a consequence of selfpropagating stochastic starformation. The bubble and shell structures are a natural byproduct of the starforming process. Fig. 2 shows the cold gas disk structured by a multitude of bubbles and shells. The supergiant shells (Meaburn, 1980) are the result of a sequential succession of starforming events. Stochastic selfpropagating starformation is the driving mechanism. Those large gas structures then are not caused by one star generation, but by a quick succession of stellar generations, spreading out from one ignition region to the enormous ionized ring-like gas filaments like Shapley III.

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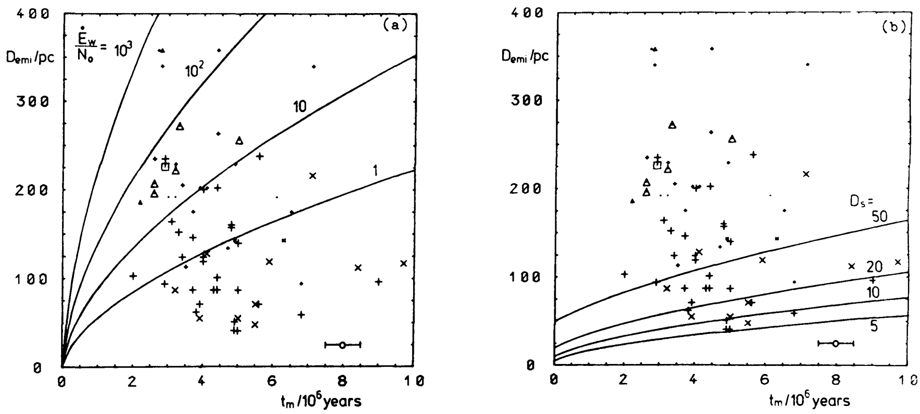

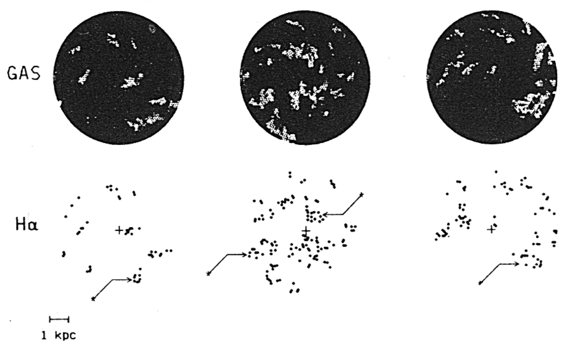

Fig. 1 Diameters of emission regions (D_{emi}) coinciding with associations in the LMC versus age (t_m) of the association. The symbols +, x, Δ, ◻ mark the association classes: very certain ... uncertain (star clouds). The symbol size is proportional to the weight given to the coincidences of emission regions and associations.

a) Evolutionary tracks of wind driven bubble diameters with the mechanical stellar wind power $\dot{E}_W/10^{36}$ erg/s and the density of the ambient medium N_0/cm^3

b) same as (a) for expanding HII regions; D_s is the initial Strömgren diameter

Fig. 2 One model of the gas distribution of the LMC and the simulation of an Hα picture at three different time steps. A range of 20 in gas density is shown; the white areas mark the regions of lower gas density. In the Hα pictures some shells are marked by arrows (compare Feitzinger et al., 1981)

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