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Star Clusters Triggered by GS242-03+37

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Abstract. We explore the Milky Way supershell GS242-03+37. We argue that the observed HI distribution can be explained as an expanding structure about 100 Myr old powered with a modest energy released by an OB association. The formation of star clusters has been triggered less than 30 Myr ago when the ISM density in the supershell increased due to the galactic differential rotation. The observed age sequence of young star clusters is related to the evolution of the column density during the supershell expansion.

Keywords. ISM: structure, ISM: bubbles, Galaxy: disk, open clusters and associations: general

1. Introduction

The interstellar medium (ISM) is composed of several components: very hot X-ray gas, warm ionized HII, warm and atomic HI, and cold and dusty molecular medium. It is highly structured from a relatively smooth hot component, through a diffuse atomic medium, and to more compact molecular clouds. Stars are formed in very dense and cold cores inside of molecular clouds. Surveys of HI in the Milky Way and in other nearby galaxies discovered shells and bubbles: Heiles (1979), McClure-Griffiths *et al.* (2002), Ehlerová & Palouš (2005, 2013); Bagetakos *et al.* (2011). Some of these shells are expanding and collecting ISM into narrow sheets of higher density and lower temperature. We analyze the connection between HI shells, molecular clouds and young star clusters: if the star clusters could have been created out of molecular clouds whose formation have been triggered by expanding shells. The statistical correlation between shells and CO distribution in the Milky Way show increased frequency of molecular clouds near the high density shell walls (Ehlerová & Palouš 2016) proving that at least some of the clouds form out of gas collected by shells.

In this contribution, we explore the giant supershell GS242-03+37 discovered by Heiles (1979). The detailed description of it is given by McClure-Griffiths *et al.* (2006) with the estimates of its age and energy necessary for its formation. Here we propose a different scenario of its formation and evolution including the effect of the galactic differential rotation. We propose for GS242-03+37 a much larger age of about 100 Myr and a much smaller energy necessary for its formation corresponding to a few tens of supernovae. The details of our analysis are described in Ehlerová & Palouš (2018).

2. GS242-03+37 and Galactic Differential Rotation

GS242-03+37 is a giant supershell of a kpc size. In any model of formation and evolution of such large structure we need to include the effect of the galactic differential rotation. This was explored by the hydrodynamical simulations of expanding shells using infinitesimaly thin shell apoproximation adopted in the code RING described by Ehlerová & Palouš (2018). The shape of GS242-03+37 and its observed expansion velocity may be explained as a combination of original expansion velocity decelerated

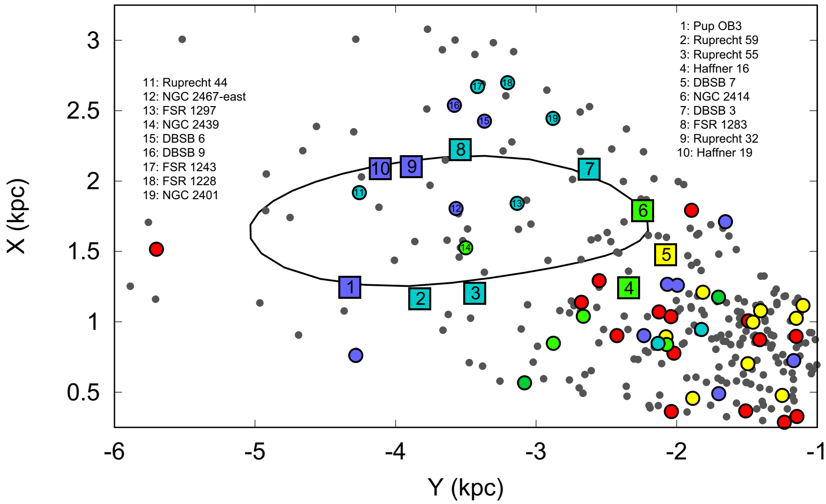

Figure 1. Supershell (solid line) and star clusters (age < 120 Myr - colors, age > 120 Myr - black, inside of the wall - squares). Projection to the galactic (X, Y) plane.

due to accretion of an ambient ISM and the galactic differential rotation. An implication is that it needs about 100 Myr to reach its actual shape in the differentially rotating galactic disk. The energy necessary for its formation is only about 1.3 10^{52} erg since its observed velocity extent contains also the galactic differential rotation. The large age opens the question on its coherence. We argue that its position in the outer part of the Milky Way in the region near to the corotation with spiral arms causes low frequency of perturbations, which makes its long survival possible.

3. GS242-03+37 versus Star Clusters

The positions of young (< 120 Myr) open star clusters correlate with the shape of GS242-03+37. This is shown in Fig. 1, where we see that star clusters reside preferentially in supershell walls. On the top of it, the older clusters are seen near its tips and younger clusters on its sides. We explain it as an effect of the mass accummulation, which is more effective at the supershell tips compared to its walls.

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