Triggered Star Formation in a Turbulent ISM
Proceedings IAU Symposium No. 237, 2006
B. G. Elmegreen & J. Palouš, eds.

doi:10.1017/S1743921307001792

High supernova rate and enhanced star-formation triggered in M81-M82 encounter

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It is a general belief that the starburst activity of a nearby galaxy M82 was triggered in a close encounter with its massive companion M81, a few tens of million years ago. Despite the lack of supernovae observed, multiwavelength radio observations of M82 discovered a considerable number of compact supernova remnant candidates. We use these remnants to estimate the supernova rate (SNR) and the enhanced star-formation (SFR) rate in M82, and compare them with rates in normal galaxies.

Since the nature and evolutionary status of M82 remnants is controversial we will rely on the most compact objects only (Table 1). For the three unresolved sources 42.7+58.2, 44.9+61.2 and 46.6+73.8, we can estimate the time of explosion by assuming that they are all younger than 43.3+59.2, and knowing that 46.6+73.8 appeared in the 1990 image of Huang *et al.* (1994), but not in the 1981 image of Kronberg, Biermann & Schwab (1985), that 44.9+61.2 must be older than 1981 since it appeared in both images, and that 42.7+58.2 in a complex region must be older than 1990. The mean time between two successive explosions is $\tau = 12 \pm 7$ yrs. The SNR is then simply $\nu = \tau^{-1} = 0.08 \pm 0.05$ yr^{-1}, and SFR($\mathcal{M} \geqslant 5\mathcal{M}_\odot$) $\approx 25\nu = 2\ \mathcal{M}_\odot$ yr^{-1}. Expressed in supernova units (SNu = number of SNe per $10^{10} L_\odot^B$ per 100 yrs), $\nu_{\rm M82} = (0.22 \pm 0.19) \times 100$ SNu, while the average core-collapse supernova rate in irregular galaxies (Cappellaro *et al.*1999) is $\nu_{irr} = 0.87 \pm 0.55$ SNu. SNR and SFR in M82 thus exceeds the rate in a corresponding non-starburst irregular galaxy of the same blue luminosity for about two orders of magnitude!

Table 1. Supernova event date estimates for M82 remnants, including SN 2004am.

Supernova	Diameter[a] D (pc)	Date t (yr)
41.9+58.0	0.5 ± 0.1	1955 ± 10^a
43.3+59.2	0.6 ± 0.1	1967 ± 5^b
44.9+61.2	< 0.5	1971 ± 10
42.7+58.2	< 0.5	1975 ± 15
41.5+59.7	< 0.5	1980 ± 1^a
46.6+73.8	< 0.5	1985 ± 5
SN 2004am	—	2004 ± 0^c

[a]Huang *et al.* (1994), [b]Beswick *et al.* (2006), [c]Singer, Pugh & Li (2004).

Acknowledgements

The authors acknowledge the financial support provided by the Ministry of Science and Environment of Serbia through the projects No. 146003 and 146012.

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