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Tidally-induced Super Star Clusters in M82

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Abstract. Using new *HST* imaging, we identify a large, evolved system of super star clusters in a disk region just outside the starburst core in the prototypical starburst galaxy M82, "M82 B." This region has been suspected to be a fossil starburst site in which an intense episode of star formation occurred over 100 Myr ago, which is now confirmed by our derived age distribution. It suggests steady, continuing cluster formation at a modest rate at early times (> 2 Gyr ago), followed by a concentrated formation episode ~ 600 Myr ago and more recent suppression of cluster formation. The peak episode coincides with independent dynamical estimates for the last tidal encounter with M81.

1. M82, the prototypical starburst galaxy

Observations from radio to X-rays show evidence for a tidally-induced starburst in the center of M82 (e.g., Telesco 1988) In fact, there is now evidence that M82 has undergone multiple episodes of intense star formation (cf. Marcum & O'Connell 1996, de Grijs, O'Connell & Gallagher 2001). "M82 B," the fossil starburst region, has exactly the properties of an *evolved* starburst with a similar amplitude to the active burst (Marcum & O'Connell 1996). Thus, M82 is a unique starburst galaxy, since no other galaxy offers the opportunity to study two discrete starbursts at such close range! By analogy with the *HST* results from the active starburst region (O'Connell et al. 1994, 1995), we expected M82 B to have contained a complement of luminous super star clusters. It is possible that most of the star formation in starbursts takes place in the form of such concentrated clusters; in M82, we do not observe any outside the starburst regions.

The combination of observations of both the active and the fossil starburst sites in M82 provides a unique physical environment for the study of the stellar and dynamical evolution of star cluster systems

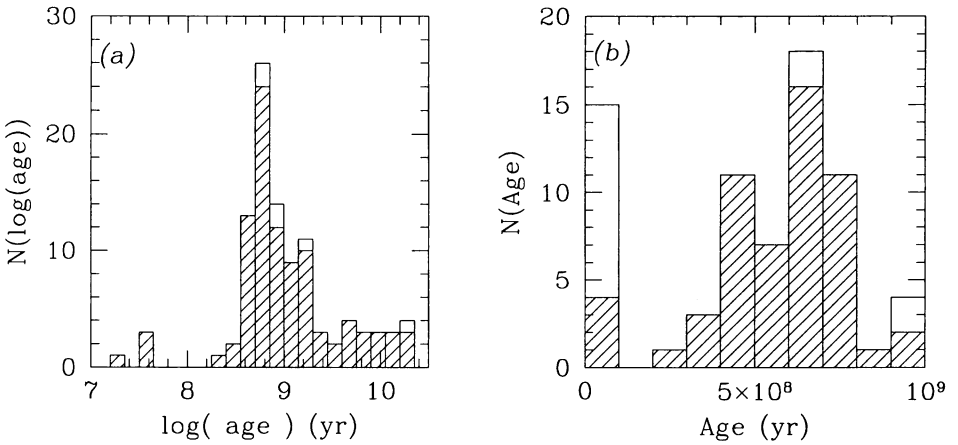

Figure 1. Age distribution of the star clusters in M82 B. Shaded histogram: well-determined ages; open histogram: upper or lower limits only (cf. de Grijs et al. 2001).

2. The star formation history in M82

Based on *HST/WFPC2* observations of two adjacent fields in M82 B (in F439W, F555W and F814W), we detected $\sim$ 100 (slightly) evolved star clusters. The clusters brighter than $V = 22.5$ exhibit a wide range of ages, from $\sim$ 30 Myr to over 10 Gyr. There is a strong peak of cluster formation at $\sim$ 600 Myr, in either representation in Fig. 1; very few clusters are younger than 300 Myr.

Our results suggest steady, continuing cluster formation at a very modest rate at early times ($>$ 2 Gyr ago), followed by a concentrated formation episode lasting from 400–1000 Myr ago and a subsequent suppression of cluster formation. Thus, it appears that the last tidal encounter between M82 and M81 $\sim$ 500–800 Myr ago had a major impact on what was probably an otherwise normal, quiescent, disk galaxy. It caused a concentrated burst of star formation activity, which decreased rapidly within a few hundred Myr.

M82 B has evidently not been affected by the more recent ($<$ 30 Myr) starburst episode now continuing in the central regions.

References

de Grijs R., O'Connell R.W., Gallagher J.S., 2001, AJ, 121, 768

Marcum P., O'Connell R.W. 1996, in: From Stars to Galaxies: The Impact of Stellar Physics on Galaxy Evolution, eds. Leitherer C., Fritze-von Alvensleben U., Huchra J., San Francisco: ASP, p. 419

O'Connell R.W., Gallagher J.S., Hunter D.A. 1994, ApJ, 433, 65

O'Connell R.W., Gallagher J.S., Hunter D.A., Colley W.N. 1995, ApJ, 446, L1

Telesco C.M. 1988, ARA&A 26, 343

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