# Environmental Effects on the Star Formation Mode in M82

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The last tidal encounter between M82 and M81 about 500 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, as evidenced by the peak in the age distribution of the cluster sample in M82's fossil starburst region "B" (de Grijs et al. 2001; cf. Fig. 1), which decreased rapidly within a few hundred Myr.

Comparison of the cluster ages with the integrated light dating ($\sim 100 - 200$ Myr; Marcum & O'Connell 1996) suggests that field star formation in this older starburst may have continued at a high rate after cluster formation had begun to decline, but the uncertainties in the age estimates are too large to be certain. Field star formation continued, probably at a much lower rate, until $\sim 20$ Myr ago (de Grijs et al. 2001). It has evidently been suppressed during the last $\sim 10 - 15$ Myr, during which the starburst in the core of M82, "M82 A, C" (cf. Fig. 1) has been most active.

Evidence for supernova remnants in the parts of region B nearest the starburst core (de Grijs et al. 2000), but not in areas more distant from the active starburst, indicates that disk star formation during the last 50 Myr was more active nearer the nucleus.

The current, active starburst is probably related to late infall of tidally disrupted debris from M82 itself, the time-scale for which is not unlikely as evidenced by the complicated structures seen in neutral hydrogen gas (e.g., Yun et al. 1993).

Combining the age diagnostics from M82's basic building blocks, namely the young star clusters in its central region, the supernova remnants in the fossil starburst, and the underlying stellar disk, I argue therefore that, in fact, the complicated star formation history in the inner $\sim 1000$pc of M82 is a combination of two mechanisms, namely the propagation of star formation on the relatively small scales of both the active core and fossil starburst region (cf. Satyapal et al. 1997, de Grijs et al. 2000), while the overall evolution of the starburst is due to tidal debris from the older starburst raining back onto the disk of the galaxy, causing the present-day starburst.

Finally, the evidence for decoupling between cluster and field star formation is consistent with the view that (super) star cluster formation

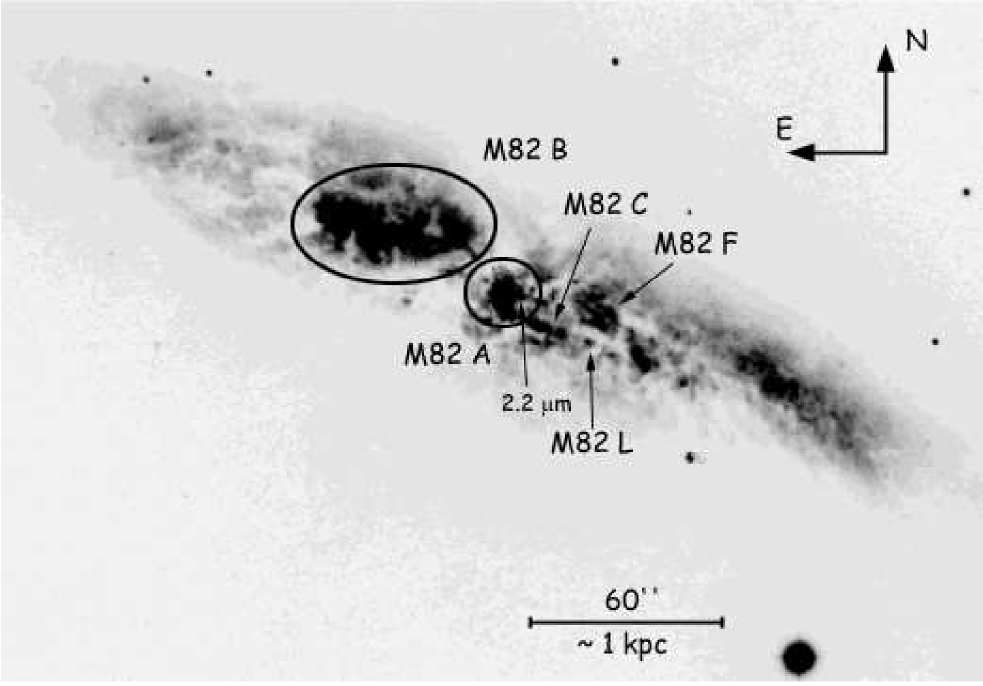


*Figure 1.* M82 *B*-band image obtained at the Palomar 5m telescope, taken by A. Sandage (exposure time 20 minutes, seeing $\leq 1''$). The locations of the active starburst core in M82 A and C, and the older starburst region M82 B are indicated, as well as the brightest star clusters, F and L. We have also indicated the location of the 2.2 $\mu$m peak coincident with the galactic centre.

requires special conditions, e.g., large scale gas flows, in addition to the presence of dense gas (cf. Ashman & Zepf 1992, Elmegreen & Efremov 1997). It is likely that these conditions are met in interacting systems such as the M81/M82/NGC3077 group.

## References

Ashman K.M., Zepf S.E. 1992, ApJ, 384, 50

de Grijs R., O'Connell R.W., Becker G.D., Chevalier R.A., Gallagher J.S. 2000, AJ, 119, 681

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

Elmegreen B.G., Efremov Y.N. 1997, ApJ, 480, 235

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

Satyapal S., et al., 1997, ApJ, 483, 148

Yun M.S., Ho P.T.P., Lo K.Y., 1993, ApJ, 411, L17