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Cluster galaxy infall and tidally-induced star formation

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Abstract. An Hα survey of cluster galaxies shows an enhancement of tidally-triggered star formation. This starburst enhancement occurs in spirals infalling to the cluster centres.

1. Introduction

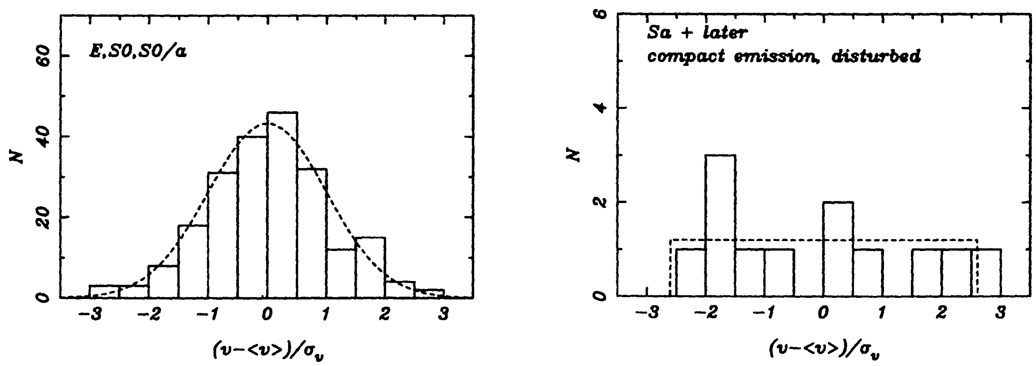
Intermediate redshift rich clusters contain a significant spiral population ($\leq 50\%$) which has been drastically depleted and largely replaced by S0 galaxies in rich clusters at the present (e.g. Dressler et al. 1997). Low-redshift clusters may be used as laboratories for detailed study of environmental effects which are likely to have modified the cluster disk galaxy population over the past several billion years.

We have completed an objective prism Hα survey (cf. Moss & Whittle 2000) of an essentially complete sample of all CGCG galaxies within 1.5 Abell radii of the centres of 8 low-redshift clusters (viz. Abell 262, 347, 400, 426, 569, 779, 1367 and 1656). These data can be used to study effects on disk galaxy star formation over a range of environments from the supercluster field to the centre of the Coma cluster.

Some 5.3% of early-type galaxies (E,S0,S0/a) are detected in emission as compared to 41% of types Sa and later. We distinguish between compact and diffuse emission (cf. Moss & Whittle 1993). For the early-type galaxies, the detected emission is predominantly compact emission from AGNs (cf. Moss & Whittle 2002). For types Sa and later, it is predominantly HII emission, in approximately equal parts either diffuse emission resulting from normal star formation in the galactic disk, or compact emission resulting from circumnuclear starburst emission (cf. Moss & Whittle 2000).

2. Spiral infall and tidally-induced star formation

In previous work, we have established an enhancement of circumnuclear starburst emission with increasing cluster central galaxy density (i.e. the fraction *of spirals* with starburst emission *increases* with cluster density, although the fraction of the overall galaxy population which are spirals *decreases*). A Kendall rank test shows that this enhancement of starburst emission predominantly oc-



curs in cluster spirals which are morphologically disturbed. Thus the enhanced starbursts appear due to tidally-induced star formation, perhaps, for example, from galaxy–galaxy interactions in infalling groups, or from tidal shocks associated with sub-cluster merging.

In the Figure we show the combined distribution for 7 clusters ($r \leq 1.0r_A$) of galaxy velocity residuals with respect to the cluster mean velocity ($< v >$) normalised by the cluster velocity dispersion (σ_v).[1] In the left-hand panel is the sample of E,S0,S0/a galaxies whose distribution is well fitted by a Gaussian, indicating that this population is virially relaxed. In the right-hand panel, is the sample of types Sa and later which both have compact emission and which are morphologically disturbed. This sample has a very high velocity dispersion ($\sigma \sim 1.7\sigma_v$). The distribution of velocity residuals is non-Gaussian (significance level $\sim 10^{-4}$), but is well fitted by the expected distribution for an infalling shell of galaxies (dashed line). This suggests that the enhanced tidally-induced star formation in cluster spirals is associated with first infall as the spirals enter the cluster. This scenario accords well with the reported triggering of star formation of infalling dwarfs in the Fornax cluster at a projected physical radius of around 600 kpc (Drinkwater et al. 2001), and a concentration of post-starburst galaxies at similar radii around rich clusters reported by Dressler et al. (1999).

References

Dressler, A., Oemler, A., Couch, W. J., Smail, I., Ellis, R. S., Barger, A., Butcher, H., Poggianti, B. M., & Sharples, R. M. 1997, ApJ, 490, 577

Dressler, A., Smail, I., Poggianti, B. M., Butcher, H., Couch, W. J., Ellis, R. S., & Oemler, A. J. 1999, ApJS, 122, 51

Drinkwater, M. J., Gregg, M. D., Holman, B. A., & Brown, M. J. I. 2001, MNRAS, 326, 1076

Moss, C., & Whittle, M. 1993, ApJ, 407, L17

Moss, C., & Whittle, M. 2000, MNRAS, 317, 667

Moss, C., & Whittle, M. 2002, in preparation

[1] Abell 569 was omitted because this is a double cluster.