1. Introduction
The most intensely star-forming galaxies in the local Universe, as discovered by the IRAS mission, contain a high fraction of morphologically disturbed or interacting systems (Sandage & Mirabel, 1996); at luminosities greater than \( 3 \times 10^{11} \) L\(_{\odot} \), they are universally classified as interacting/merging/post-merger (sib). Interacting/merging galaxies selected on the basis of peculiar optical morphologies also appear to have enhanced star formation relative to the general population (Larson & Tinsley, 1978). We have begun investigating the external factors which may influence the rate of star formation in galaxies, starting with the effects of tidal interactions. To gauge the magnitude of these effects, we have taken care to select an objective and complete sample with as little bias as possible towards star forming systems. Tidal influence on each of the galaxies in our sample is quantified by identifying and measuring the distance to the nearest companion, using a photometric technique with good completeness characteristics.

2. Methods
- Our primary sample is a complete volume (\( z \leq 0.15 \)) and luminosity limited (\( M_C < -20.45 \)) sub-sample of the SDSS `Main Galaxy Sample' (MGS).
- We have calculated star-formation rates for all of the members of the primary sample from extinction and aperture corrected H\(_\alpha\) luminosities. For those galaxies detected in the IRAS all-sky survey, we have also calculated far infrared-derived star-formation rates.
- Mass-normalised star-formation rates were derived using galaxy stellar masses estimated from \( g \)-band luminosities.
- Nearest companions were identified using the algorithms illustrated in Figure 1.
- We use the \( \nu\)-band concentration index, \( C \); Peterson half-light/ Petrosian 90%-light radii, as a proxy to galaxy morphology.

3. Results: \( H\alpha \)
- The distribution of star-formation rates in the volume limited sample is shown in Figure 2.
- Some of the red-void galaxies in our sample with close companions are illustrated in Figure 3. Although generally accurate, it can be seen that our algorithm does not identify very close companions or merging galaxies.
- We find that there is an anti-correlation between SSFR and projected separation to the nearest companion in the range \( 0 < r < 50 \) kpc in the late-type, mixed-type and early-type morphological sub-samples (Figure 4).
- The anti-correlation appears to extend to larger separations in the late-type sub-sample.
- Kolmogorov-Smirnov test confirms, at a formal confidence level greater than 99.9%, the difference in distributions of SSFR between galaxies with close companions and isolated galaxies.
- Our data do not indicate that the morphological type or mass (within the factor of six that we probe) of the companion galaxy has an effect on the triggering of star formation.

4. Results: Far-infrared
- We compare in Figure 5 the dependence on companion separation of \( H\alpha \) and far-infrared derived star-formation rates for the subset of galaxies detected by IRAS.
- There is a broad trend between the two very different measures of star-formation.
- In order to account for the possibility that both the companion and primary galaxies contribute to the measured far-infrared flux, we have indicated two normalisations in Figure 6: normalisation by just the mass of the primary galaxy only; and filled squares: \( r\)-band normalised by the mass of both the primary and companion galaxies (within 50 arcseconds).
- A tight relation between the concentration index and separation to the nearest companion is observed which we interpret as due to triggering of nuclear starbursts. Under this assumption, the observations suggest that 50 kpc is the approximate length scale at which tidal triggering occurs.
- The observed enhancement of star formation in galaxies with close companions is equally reflected in optical spectra and far-infrared emission. Although the coarse resolution of IRAS doesn't allow us to investigate in detail, our data suggest that significant star formation occurs in both of the galaxies involved in interaction.
- We do not find any statistical dependence on the morphology or mass of the companion galaxy.

5. Results: light profiles
- The relationship between the concentration index and the separation to the nearest companion is shown in Figure 6. Galaxies with companions closer than 50 kpc have on average significantly more concentrated light-profiles which are on average significantly more concentrated in the nucleus.
- Inspection of images of some of these galaxies suggests that they have normal disk components and that the observed effect may be due to nuclear starbursts.
- Some or all of the observed enhancement of star formation in mixed- and early-type galaxies with close companions may in fact be due to this effect.

6. Discussion & Conclusions
- We confirm previous findings (Baron et al. 2000, Lamba et al. 2003) that galaxies with close companions have moderately enhanced star formation compared to isolated galaxies.
- At least as far as it's discernible with the concentration index, this enhancement is reflected both across the morphological spectrum.
- A tight relation between the concentration index and separation to the nearest companion is observed which we interpret as due to triggering of nuclear starbursts. Under this assumption, the observations suggest that 50 kpc is the approximate length scale at which tidal triggering occurs.
- We do not find any statistical dependence on the morphology or mass of the companion galaxy.

References:

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