Quantitative study of the morphological evolution of post-starburst galaxies.

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Abstract

Galaxies that show evidence of a historical rapid increase and subsequent quenching in star formation could be a result of gas-rich major merger processes. Therefore, studying the properties of post-starburst galaxies is important to understand the role of mergers in galaxy evolution.

In this poster I present results of a study of post-starbursts using traditional morphology measures and show that those methods are not suitable for tracing the changes in the outskirts of those galaxies.

The ultimate goal of this work is to develop a new automated method to quantify the changes in morphology of galaxies passing through the post-starburst phase.

Visual inspection

Visual classification of 700 objects, including post-starbursts and normal star-forming galaxies, was carried out based on the presence/absence of features characteristic to post-mergers.

RESULTS OF VISUAL CLASSIFICATION

RESULT: VISIBLE TREND IN MORPHOLOGY WITH STARBURST AGE (DECLINING POST-MERGER FEATURES).

Conclusion and future work

The visual classification of post-starbursts results in excess of post-merger features declining steadily with increasing starburst age. However, the traditional automated methods of morphology measurement do not reliably identify those features.

A new automated method is needed to measure the evolution of faint structures in the outskirts of galaxies. This method will be used to show how the evolution of the morphology of starburst galaxies through the post-starburst phase resembles that of galaxy mergers modelled using hydrodynamic simulations.

Question:

POST-STARBURST = POST-MERGER ???

Post-starburst galaxies are systems that show signatures of a historical rapid increase in star formation, typically confined to their central regions.

Galaxies with post-starburst stellar populations can be identified using their spectral continuum indices (Principal Component Analysis, Wild et al, 2007). As they age, post-starbursts move across the PC1-PC2 space, while becoming dominated by A-type stars.

ARE POST-STARBURSTS THE REMNANTS OF GALAXY MERGERS?

WILL THEY EVOLVE INTO RED-SEQUENCE GALAXIES?

The inefficiency of the visual classification outweighs its reliability. In order to study large galaxy samples we need to automate the classification process. There are various measures of morphology in literature, that have been used to study galaxy structure in an automated manner:

- SERSIC INDEX (Sersic, 1963) - a measure of steepness of the galaxy light profile;
- CAS PARAMETERS (Conselice, 2003) - concentration, asymmetry and clumpiness of the galaxy light distribution;

Applying those methods to the SDSS r-band images of a sample of 600 post-starburst galaxies (coloured data points in the PC1-PC2 plot) showed no trends in any of the parameters considered, with the starburst age:

\[
\begin{array}{c|c|c|c}
\text{Starburst age [Gyr]} & \text{PC1} & \text{PC2} & \text{Age} \\
\hline
0.0 & 1.0 & 0.2 & Wild et al, 2010 \\
0.1 & 0.9 & 0.3 & Grey data points - values for individual objects in the sample; \\
0.2 & 0.8 & 0.4 & Blue data points - median values in 0.1-Gyr age bins.
\end{array}
\]

RESULTS OF VISUAL CLASSIFICATION

Fraction of post-starbursts identified as post-mergers

PERSON 1
PERSON 2
PERSON 3
ALL

Grey data points - values for individual objects in the sample; Blue data points - median values in 0.1-Gyr age bins.