by measuring the luminosity function and its evolution, we can better understand what factors contribute to the star formation rate, growth and evolution of galaxies. Selecting galaxy samples based on colour or morphology can provide additional information as galaxy shape measures the distribution, and reflects the motions, of stars within a galaxy. Colour is connected to galaxy stellar populations, blue being younger, star forming and red being older.

Observationally, colour and galaxy shape correlate and thus, are often used as proxies for one another, that is, we assume that the majority of spirals should be blue and the majority of ellipticals and lenticulars should be red. Previous studies of local luminosity functions with morphology-selected samples have largely produced conflicting results and functions with varying shapes (Marzke et al., 1998, Kochanek et al., 2003, Devereux et al., 2009). Unexpectedly, such functions differ from functions derived from colour-selected samples (Bell et al., 2004, Brown et al., 2007), that is, early-type functions have faint end slopes which are flat or positive rather than the negative slopes observed in typical red galaxy luminosity functions.

We have created a dataset primarily using 2MASS, 6dF and RC3 data, limited to \( K_{\text{lim}} < 10.75 \) mag and 704 < cz < 20,000 km/s, comprised of 13,321 galaxies, each with corresponding flow corrected redshift/redshift-independent distances and morphological classifications. We derived K-band local galaxy luminosity functions for our total sample as well as for late and early-type galaxies (Figures 1 and 2). We have also investigated the colour distributions of the different morphological populations (Figure 3).

Our results indicate a difference in the shape of our functions when compared to similar colour-selected luminosity functions. This is at least partially explained by a large population of \( M_{K} < -23 \) mag, high stellar mass red spiral galaxies Figures 4, 5, 6 and 7, which are included in our sample. If we add these red spirals to our early-type sample, and correct our galaxy counts for overdensities in the local Universe, the resulting luminosity function has a shape more similar to that observed for color selected red galaxy LF’s.

In terms of the red spirals themselves, with such large stellar masses and such obvious structure, it is unlikely that these objects are formed through mergers or have recently blue stellar populations. If red spirals are formed through a more likely process such as the truncation of star formation, they must be relics of a much earlier age.

References


Background image: red spiral galaxy NGC2768 from NASA.