Herschel-ATLAS

Star-formation history and characteristics of low redshift galaxies

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INTRODUCTION

Results from large sky surveys such as the Sloan Digital Sky Survey (SDSS) have revealed that the distribution of galaxy colours is bimodal, i.e., the so called ‘blue cloud’ versus the ‘red sequence’. While the former mainly consists of star-forming galaxies, the latter is populated by early-type passive galaxies (i.e., having little or no current star formation) with additional minor contributions from heavily obscured star-forming galaxies or edge-on systems.

Results based on Herschel-ATLAS, suggest that vast majority of low-redshift galaxies detected by Herschel are blue/star-forming. In fact it is believed that in comparison to quiescent systems, star-forming galaxies are heavily affected by internal dust which is responsible for the observed far-infrared and submillimeter emissions from warm and cold dust components in such objects.

Besides, Herschel detects a remarkable fraction of red galaxies with sub-submillimeter emission. The question is whether such red galaxies are evolved/early-type galaxies or they are highly obscured star-forming galaxies? In the present study, we try to answer this question from the analysis of the spectral energy distribution of submillimeter galaxies.

DATA

In this study we use the H-ATLAS standard source catalogue which is supplemented with cross-identification information from the Galaxy And Mass Assembly redshift survey (GAMA) and SDSS DR7 surveys. Galaxies in our sample:

- are detected in 250µm Herschel submillimeter band,
- have redshift $0.02 < z < 0.2$,
- have been observed in all GALEX (NUV) + SDSS (ugriz) + UKIDSS (YJHK) bands, and
- may have been detected in GALEX (FUV) and/or 350µm and/or 500µm.

In total we find ~4100 galaxies in H-ATLAS.

ANALYSIS

MAGPHYS (Multi-wavelength Analysis of Galaxy Physical Properties) is used to recover the physical properties of submillimeter detected galaxies such as stellar mass, specific star formation rate (SSFR), dust mass etc. The code uses a Bayesian approach to interpret the spectral energy distributions (SEDs) all the way from the ultraviolet/optical to the far-infrared. An example best-fit (SED) is shown in Figure 1. Galaxies are then classified into *blue* and *red* sub-classes according to their UV-optical colour as follow:

blue → *NUV-r* < 4.5
red → *NUV-r* > 4.5

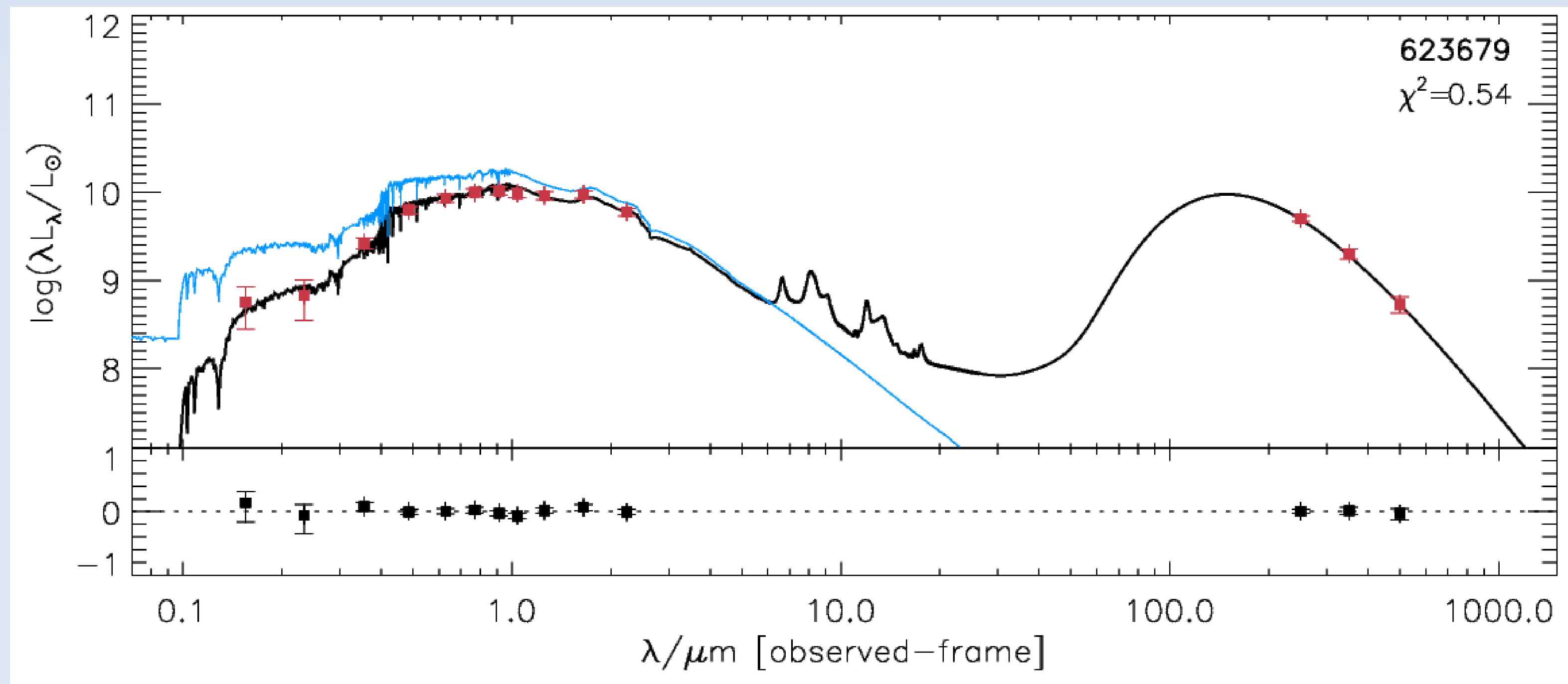

Figure.1 An example best-fit SED generated by MAGPHYS

RESULTS

(I) Vast majority of galaxies detected in H-ATLAS are BLUE/star-forming galaxies. However, we find a remarkable fraction (~14 ± 4.0 per cent) of *red* objects with submillimeter emission in 250µm. In fact, this fraction is a function of galaxy stellar mass M_* (strong correlation), and well as galaxy projected density Σ (weak correlation) as shown in Figure 2.

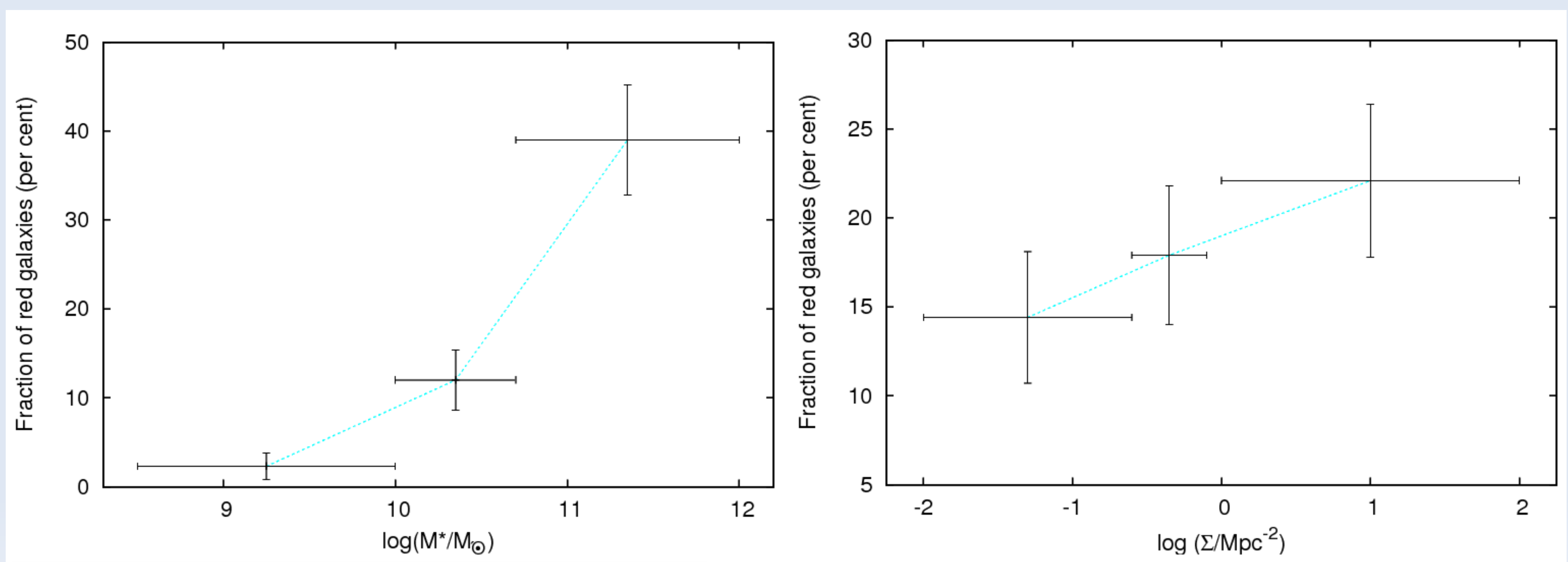

Figure.2 Fraction of *red* galaxies as a function of galaxy stellar mass M_* (left panel) and galaxy projected density *Σ* (right panel).

(II) Figure 3 shows the normalized distribution of SSFR (ψ_S /yr $^{-1}$) averaged over the last 10^8 years, as well as the fraction of total dust luminosity contributed by the diffuse ISM, f_μ, in *blue* and *red* populations. Also we split our sample into low and high stellar mass bins in order to see how the overall trend does change with galaxy stellar mass.

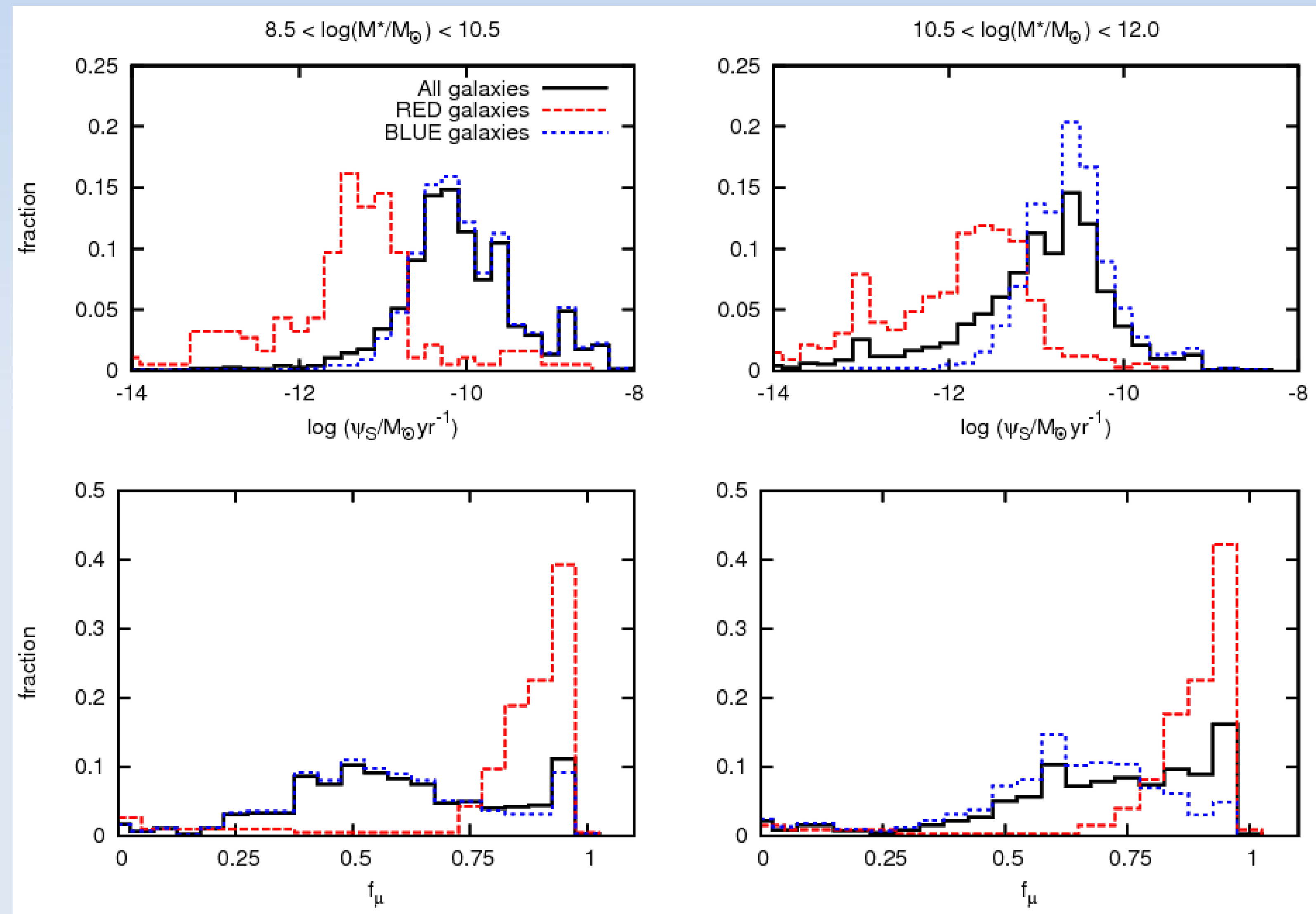

Figure.3 Normalized distribution of *SSFR* (top panel) and f_μ (bottom panel) in all galaxies (black histograms) as well as *blue* and *red* populations.

It is obvious that in comparison to *blue* sources, *red* populations consist mainly of evolved galaxies. It was also found that *red* galaxies have a lower fraction of dust-mass to stellar-mass ratio (M_d/ M_*).

FUTURE WORK: Why dust has survived in massive *red* galaxies? Does the mechanism that remove dust is less efficient in massive galaxies or massive galaxies gain dust via other processes such as galaxy-galaxy interactions? These are subject to future studies.

REFERENCES

(1) da Cunha E., Charlot S., Elbaz D., 2008, MNRAS, 388, 1595
(2) Dariush, A. et al., 2011, MNRAS, 418, 64
(3) Driver, S.P. et al., 2010, MNRAS, 413,971
(4) Eales, S. et al., 2010, PASP, 122, 499
(5) Hill, D.T., et al., 2010, MNRAS, 404, 1215