Evolution of low luminous FIR sources at z < 0.5

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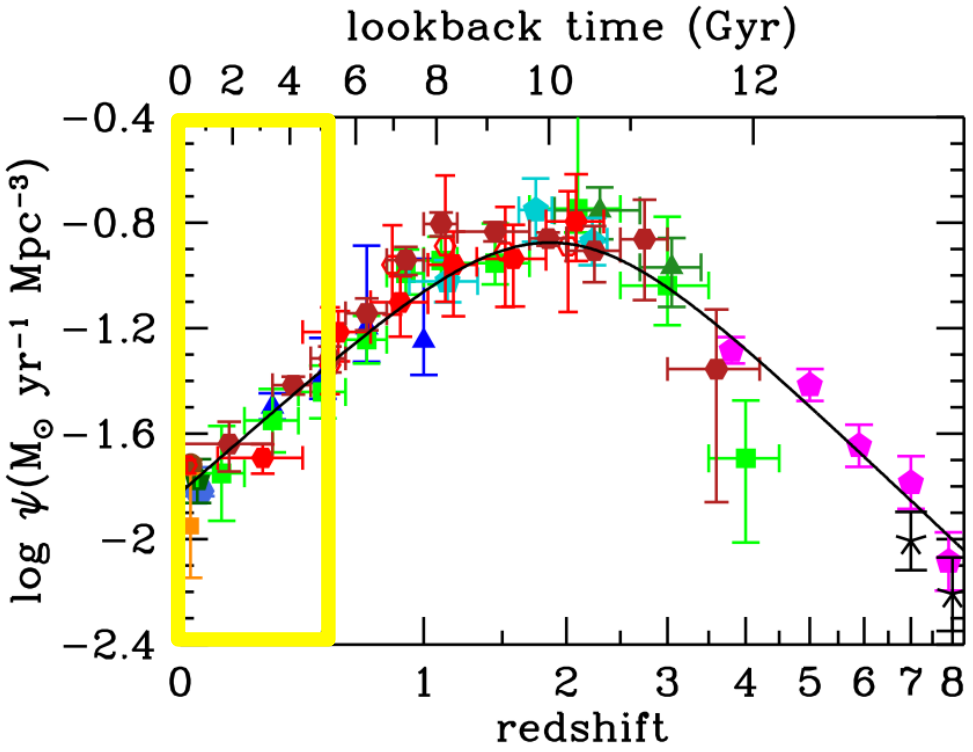
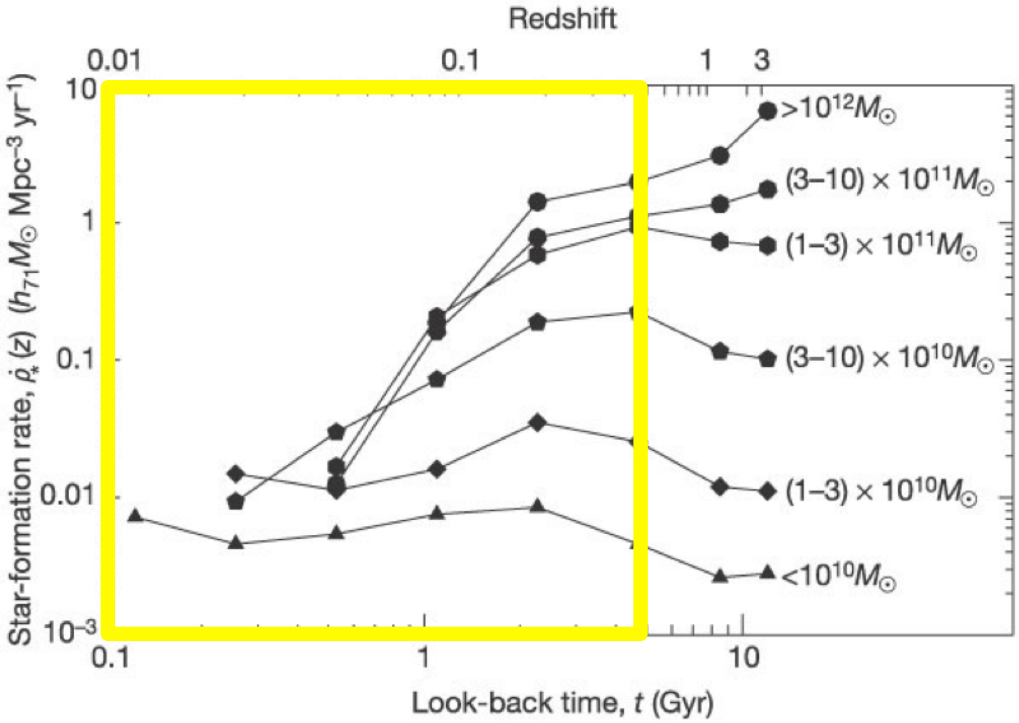
SFR Density at z < 0.5

The evolution of SFR across the Hubble time is a crucial parameter to investigate galaxy evolution

Cosmic SFR vs z (Madau & Dickinson 14)



SFR density vs z at differents M$_*$ (Heavens et al. 04)



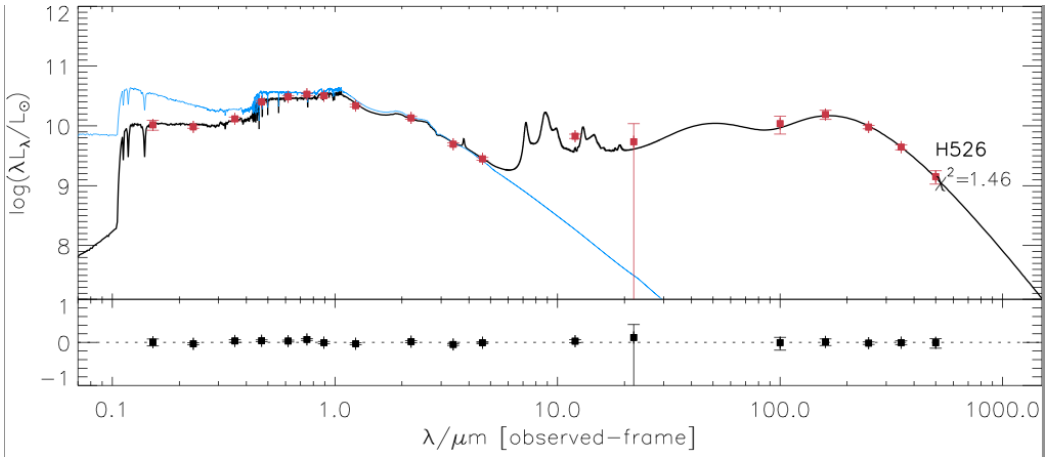
The bulk of the SFRD at low z is mainly driven by low mass object

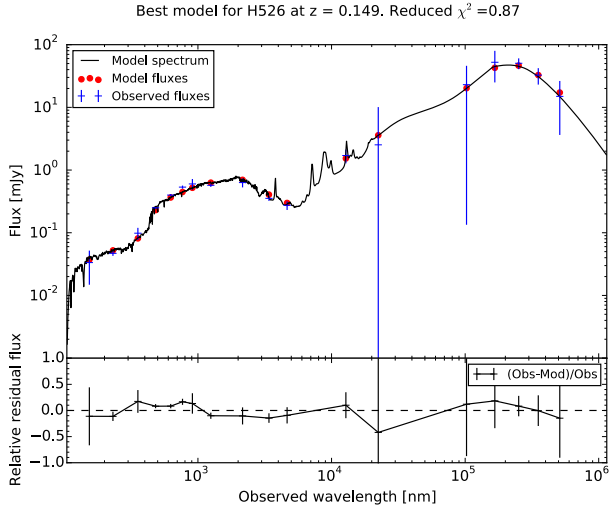
Low Luminous FIR sources

The sample:
250 micron selected sources from one of the deepest and largest Herschel survey (HeViCS, Davies et al. 12). Accurate photometry 80% complete up to 20 mJy (Pappalardo et al. 14)

Data set enriched with properly selected ancillary data:
UV: GUViCS (Boselli et al. 11) - Optical: SDSS DR10 (Ahn et al. 14)
NIR: UKIDSS-LAS (Lawrence et al. 07) – MIR: WISE (Wright et al. 10)

MAIN SAMPLE: full spectral coverage (~800 sources with median z = 0.15)
EXT. SAMPLE: no constraints in UV and IR (~5400 sources, median z = 0.25)
Methods:
MAGPHYS (da Cunha et al. 08) with IR templates from Viaene et al. 14
CIGALE (Noll et al. 09)
Both methods build stellar emission and IR emission to build a PDF of the chi square distribution.



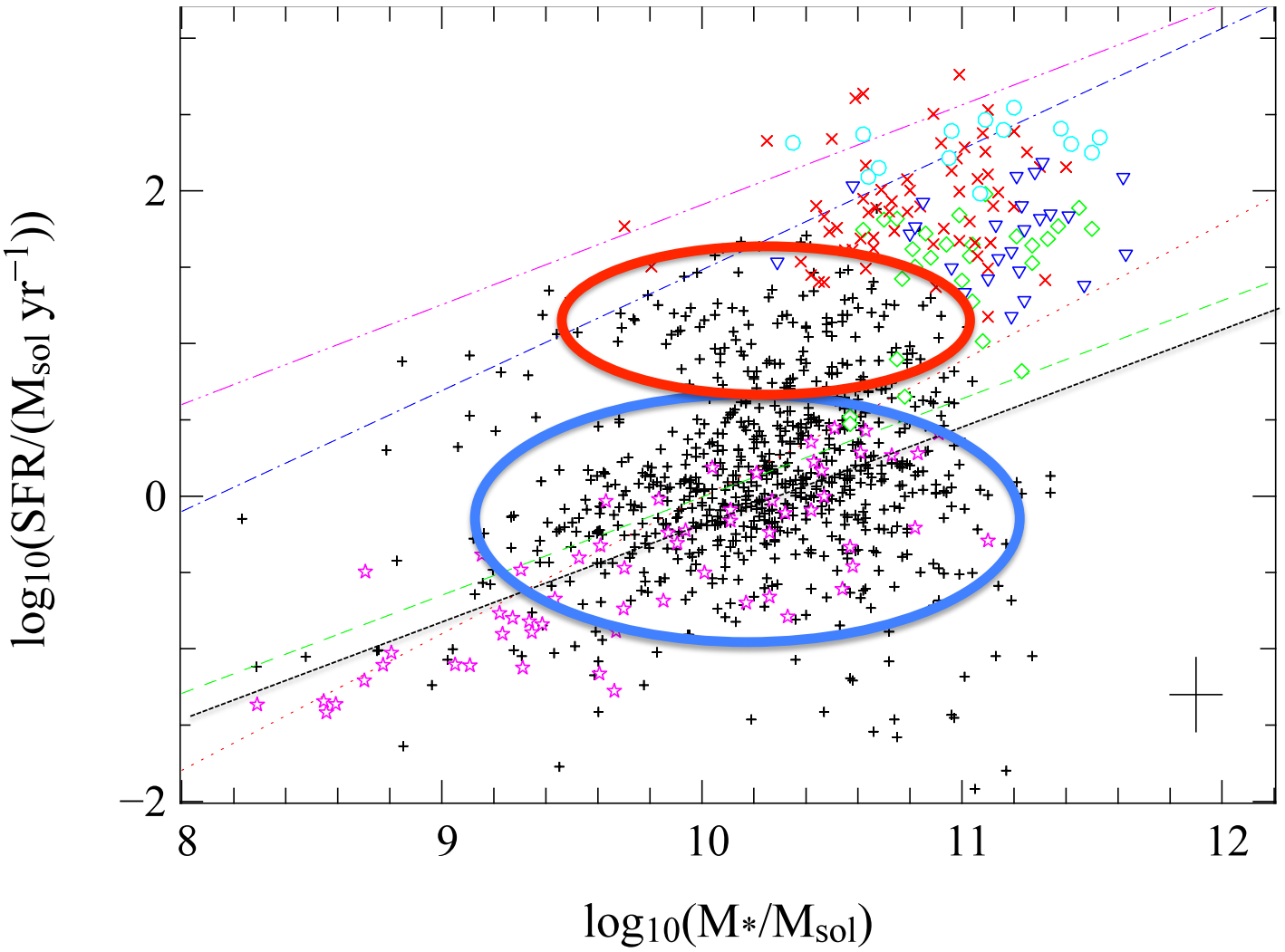


Sample properties

Parameter (1)	Main Sample (2)	Extended sample (3)
M_{dust} [$M_\odot$]	$9.8\pm1.6\times10^{7}$	$2.9\pm1.5\times10^{8}$
L_{dust} [$L_\odot$]	$2.3\pm0.3\times10^{10}$	$7.2\pm1.8\times10^{10}$
SFR [$M_\odot$ yr−1]	1.2 ± 0.3	3.3 ± 4.2
M_* [$M_\odot$]	$1.9\pm0.1\times10^{10}$	$3.7\pm0.1\times10^{10}$
M_{dust}/M_*	0.018 ± 0.002	0.026 ∓ 0.001

Main sample in the range of low LIRGs end median SFR typical of local star forming galaxies

SFR-M_* : MAIN S.



High z SF gal.
3 < z < 1
(Tacconi et al. 13)

Low z SF gal.
0.05 < z < 0.5
(Bauermeister et al. 13)

Local LIRGs at z ~ 0.4
(Geach et al. 11)

Local ULIRGs
(Gao & Salomon 04)

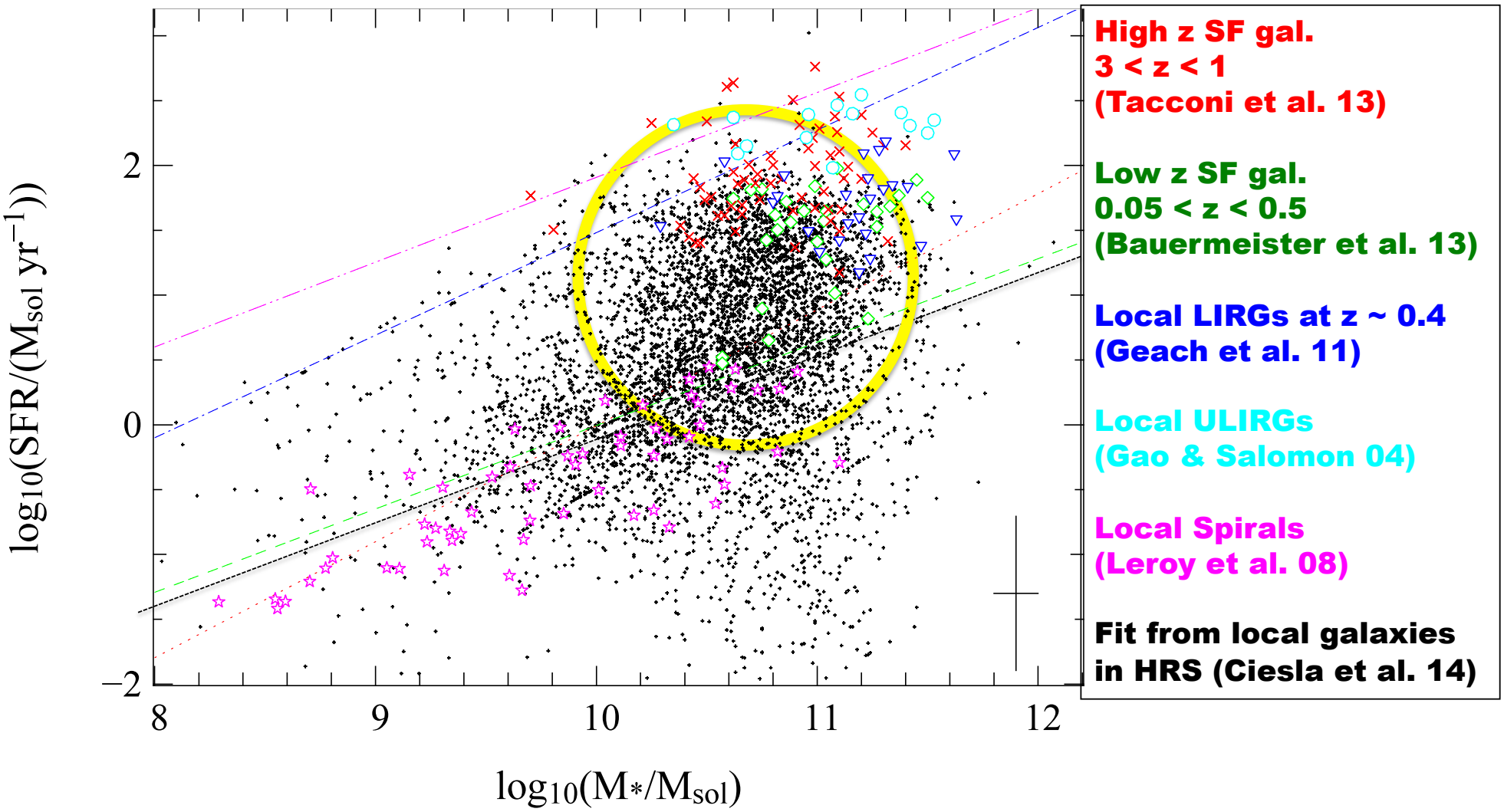
Local Spirals
(Leroy et al. 08)

Fit from local galaxies in HRS (Ciesla et al. 14)

The bulk of the main sample are galaxies with moderate SFR ~ 1 M_{sol}/yr comparable with local spirals and M_* ~ 10^{10} M_{sol}

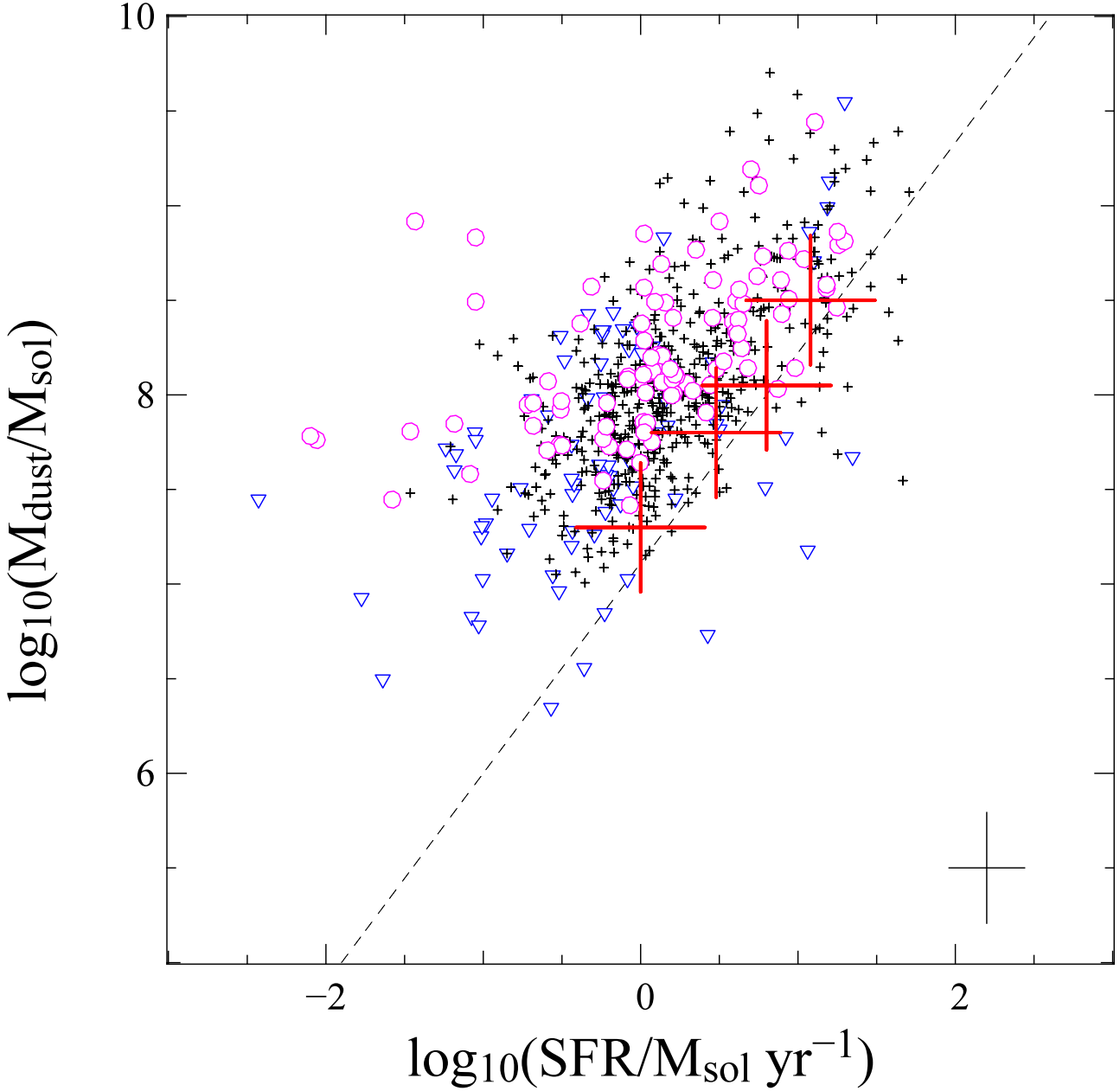
At SFR > $10^{0.5}$ M_{sol}/yr there is a similar population with higher SFR

SFR-M$_*$: EXTENDED S.



Removing constraints in the UV and NIR we found a different population.
Gal. with M_* > 3 X 10^{10} M_{sol} are not in the MS -> dusty galaxies with decreasing SF.
Low mass gal., M_* < 1 X 10^{10} M_{sol} are in the MS, with SFR and M_* consistent with local spirals.

M_{dust}-SFR in the main sample



H-ATLAS (Smith et al. 12)

$M_* < 5 \times 10^9 M_*$

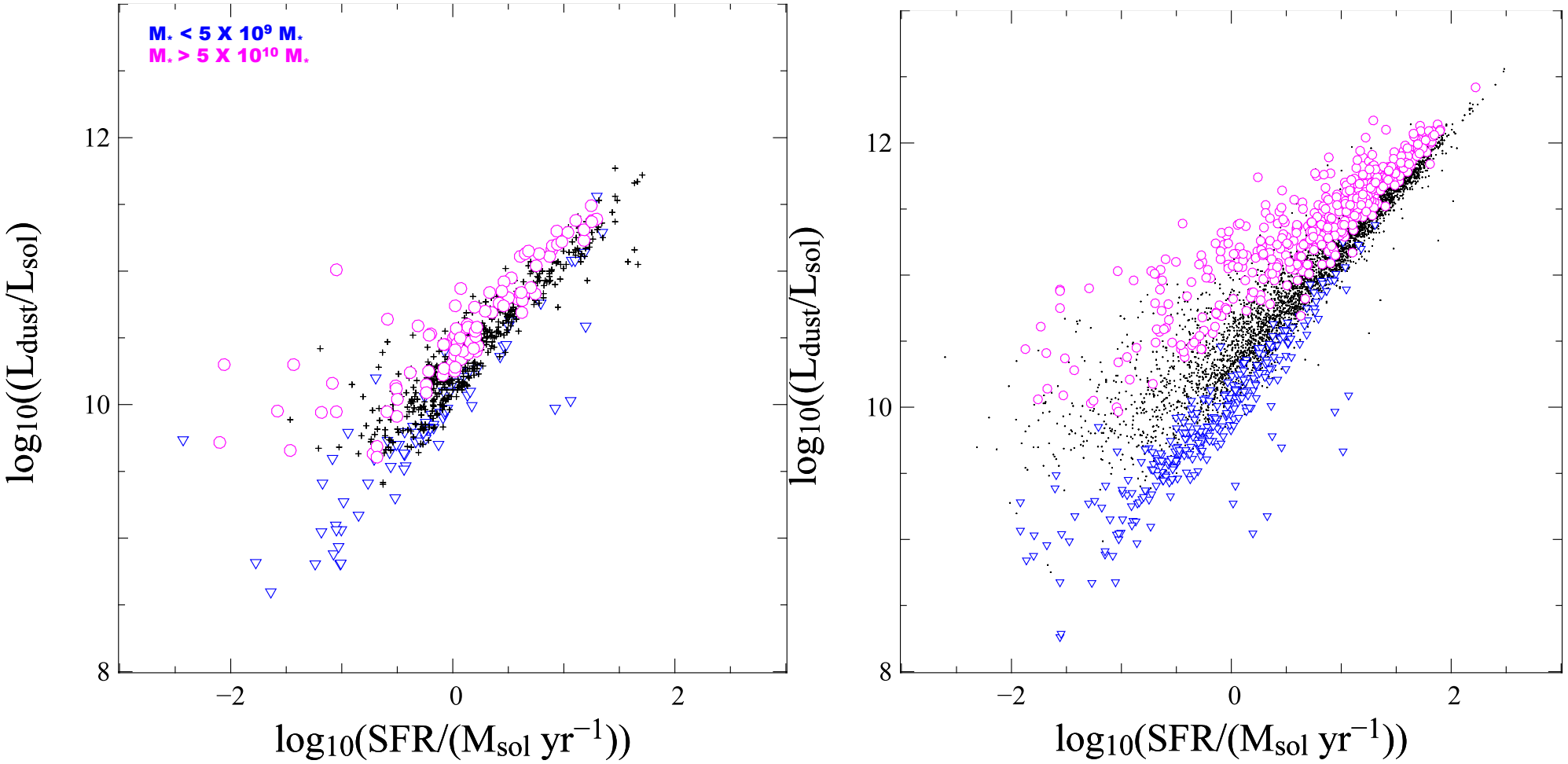
$M_* > 5 \times 10^{10} M_*$

We expect a different trend that we do not observe.

Only galaxies with higher mass have in average higher dust content.

Wrong parameter?

L_{dust}-SFR in the 2 samples



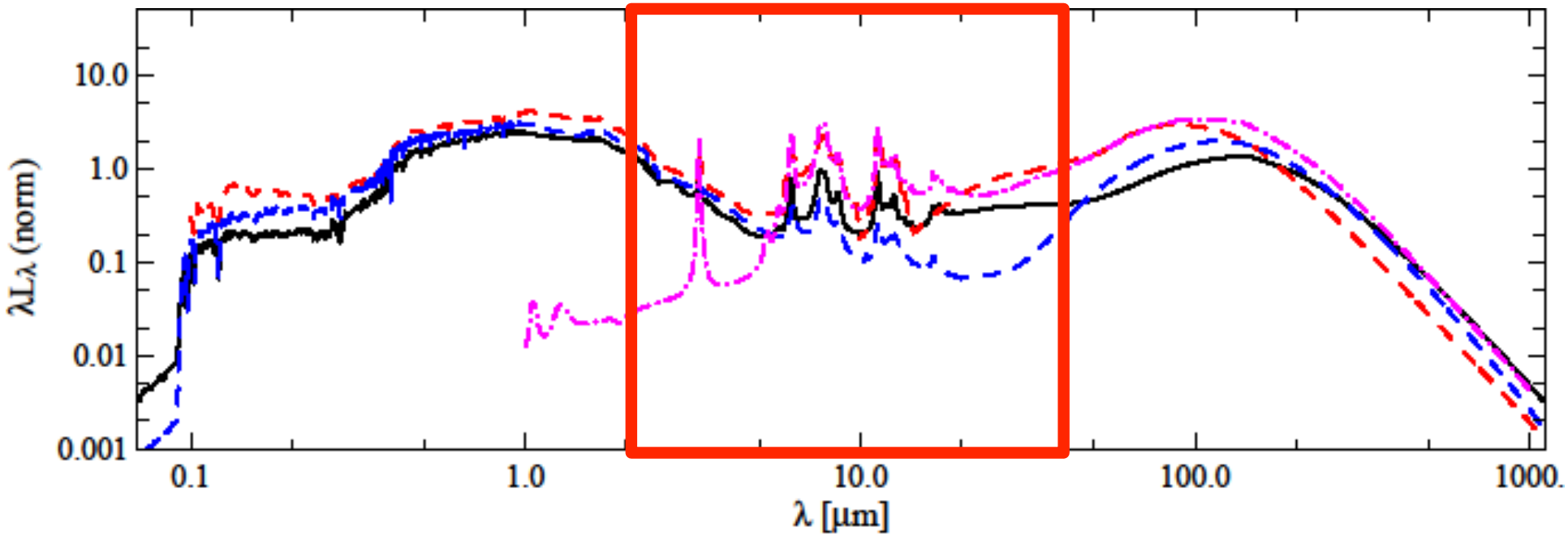
MAIN SAMPLE **EXTENDED SAMPLE**

Dust luminosity is by definition more sensitive to the warmer dust component -> more linked to the star formation process. We see two different regions in which the SFR is more or less tightly linked to the SFR.

SED templates

Why is important a SED template for low FIR luminosities?
Low FIR luminosities imply overall colder tempratures,
A condition that at high z could be more frequently than previously thought.
Different studies have found indications of a colder dust temperature in high z submm galaxies with respect to local galaxies with similar FIR luminosities (Hwang et al. 10; Magnelli et al. 12)

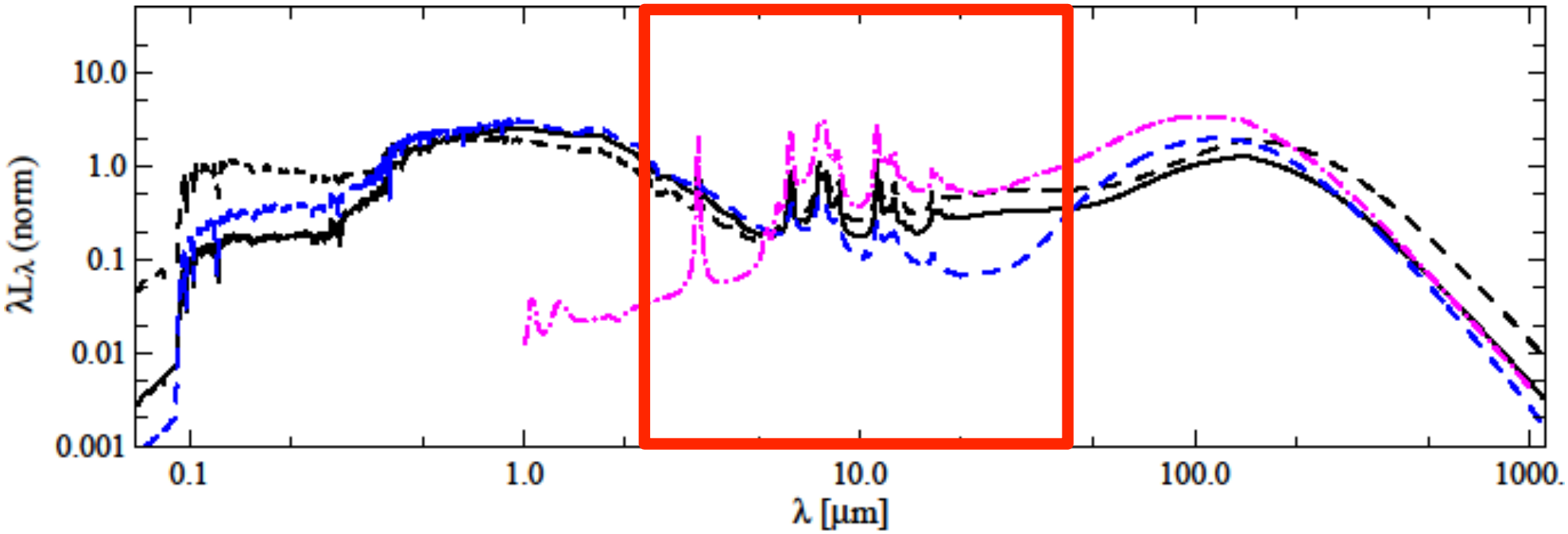
SED templates



Chary & Elbaz 01: ~ 100 gal selected between 0.44 and 850 micron
Smith et al. 12: 250 micron H-ATLAS sources
Ciesla et al. 14: ~ 150 local gas rich galaxies from the HRS (Boselli et al. 10)

Low FIR luminosities population have higher MIR emission than previously thought.
Models without constraints in the FIR (Chary & Elbaz 01) predict higher dust temperature
Models without contraints in MIR (Smith et al. 12) have lower emission in that regions
Models with constraints in the MIR and higher SFR (Ciesla et al. 12) have higher emission in that regions.

SED templates



Smith et al. 12: 250 micron H-ATLAS sources
Ciesla et al. 14: ~ 150 local gas rich galaxies from the HRS (Boselli et al. 10)

$M_* < 5 \times 10^9 M_*$: dashed line
$M_* > 5 \times 10^{10} M_*$: solid line

Low mass galaxies have higher UV and PAH emission (normalized NOT ABSOLUTE SFR)
High mass galaxies have higher dust content, higher dust temperature with decreasing star formation

Conclusions

1. **Thanks to deep Herschel data we identified a population of low mass galaxies at z < 0.5 with low star formation and moderate dust content driving the SFRD at low z**

2. **In the SFR-M_* plane galaxies with UV detection occupy a defined region intermediate between the local spirals and high z star forming galaxies**

3. **The scatter in the M_{dust}-SFR relation is drastically reduced once considered the dust luminosity, more linked to the star formation process**

4. **SED templates not using constraints in MIR tends to underpredict emission in that region. MIR is fundamental in order to build reliable SED templates to be used in high z galaxies**