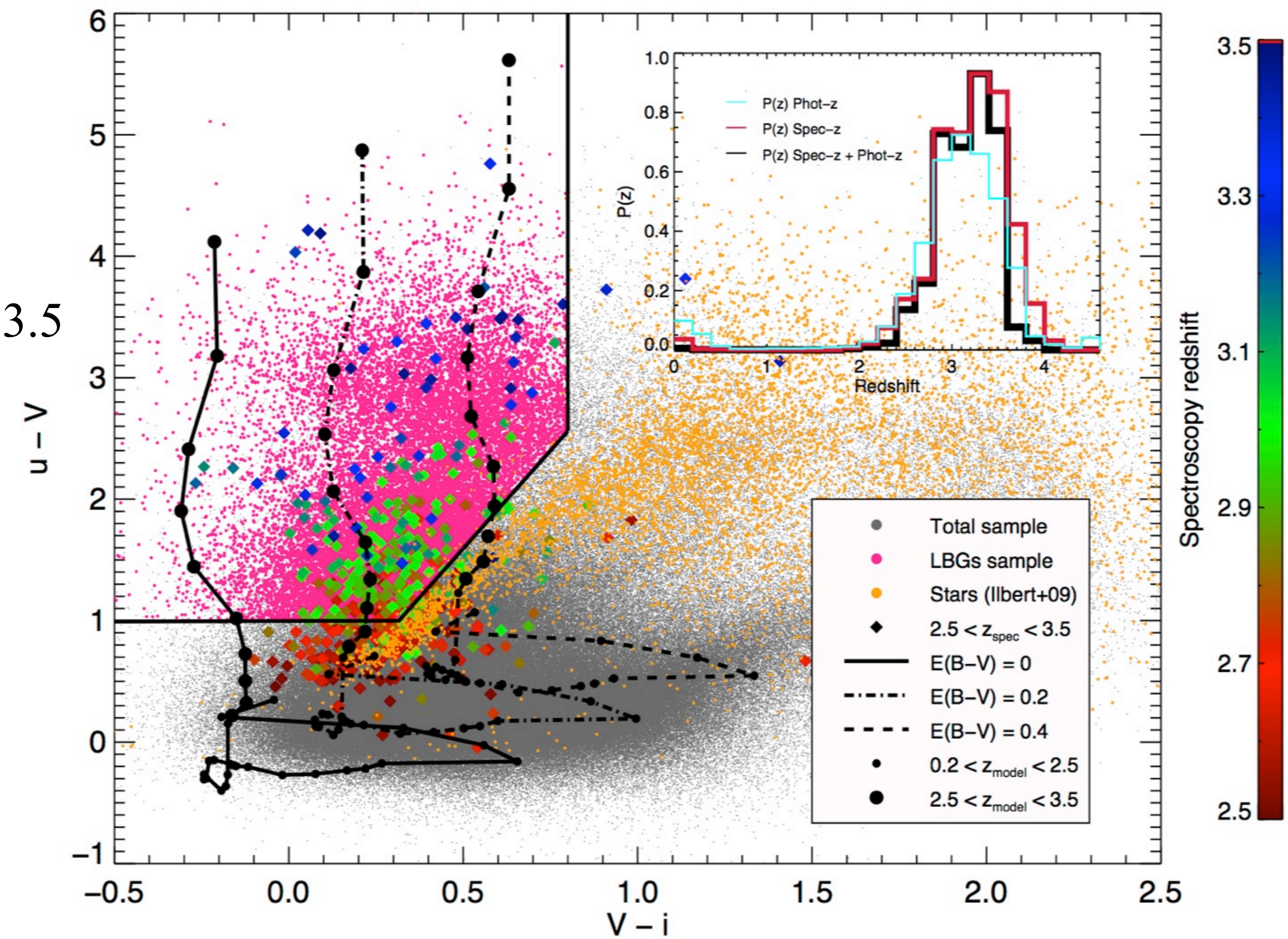
LBG sample

- **COSMOS field (2 deg²)**

- **Eliminate the low-z interlopers:** $2.5 < z_{photo} < 3.5$

- **$\log(L_{FUV}\,[L_{\odot}]) > 10.20$** (Completeness 75%)

- $< z_{photo} > = 3.02 \pm 0.25$



Sample ~ 20.000 LBGs

Stacking analysis and Binning

- **LBG samples present incompleteness at IR, which increases at longer wavelength observations. For example, less than 0.05% of our LBGs sample is detected at SPIRE-250μm.**

- **The objective of this work is to obtain the rest-frame FUV to FIR emission for LBGs population at z~3.**

- **We performed stacking analysis form the Optical to mm available wavelength observations at COSMOS field.**
    - **Optical:** SUBARU (B, V, r, i, and z bands)
    - **NIR:** UltraVISTA (Y, J, H, Ks)
    - **Mid-IR:** IRAC (3.6, 4.5, 5.8, 8μm) and MIPS (24 μm).
    - **Far-IR:** PACS (100 and 160μm) and SPIRE (250, 350, 500μm)
    - **mm:** AzTEC (1.1mm)

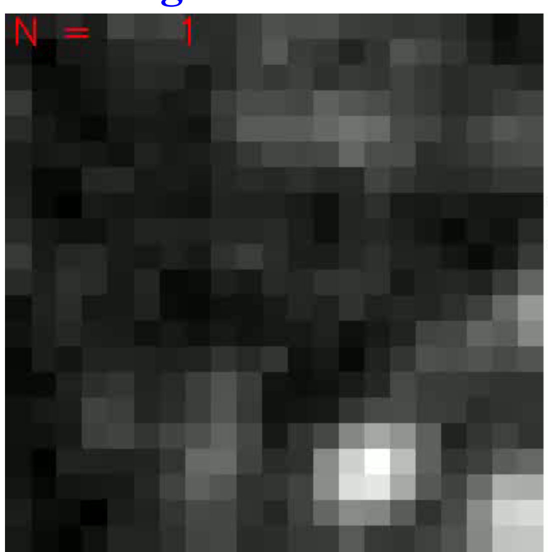
- **Our Stacking analysis have been corrected by:**
    - The incompleteness of our input catalogue in dense regions (Important for faint population)
    - The clustering of galaxies.
    - The contribution of the field sources.

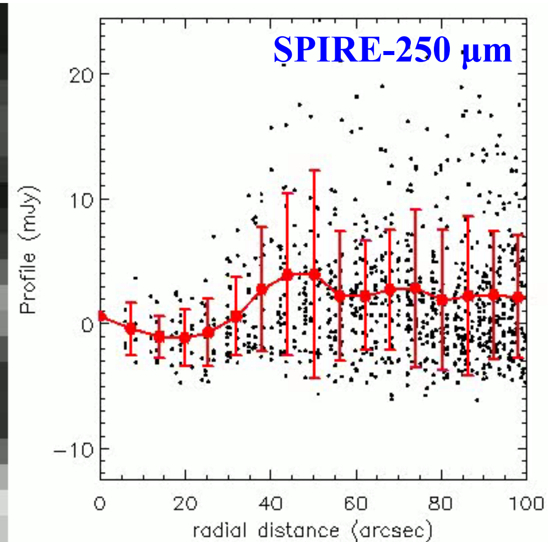
Stacking analysis and Binning

	Interval	Nº of bins
L_{FUV}	$10.2 < \log(L_{FUV}\ [L_\odot]) < 11.4$	4
β_{UV}	$-1.7 < \beta_{UV} < 0.3$	4
M_*	$9.75 < \log(M_*\ [M_\odot]) < 11.5$	6
Mβ1	1: $9.75 < \log(M_*\ [M_\odot]) < 10.65$ 2: $10.65 < \log(M_*\ [M_\odot]) < 11.5$	2 in M_* 3 in β_{UV}
Mβ2	1: $-1.7 < \beta_{UV} < -0.8$ 2: $-0.8 < \beta_{UV} < 0.3$	2 in β_{UV} 5 in M_*

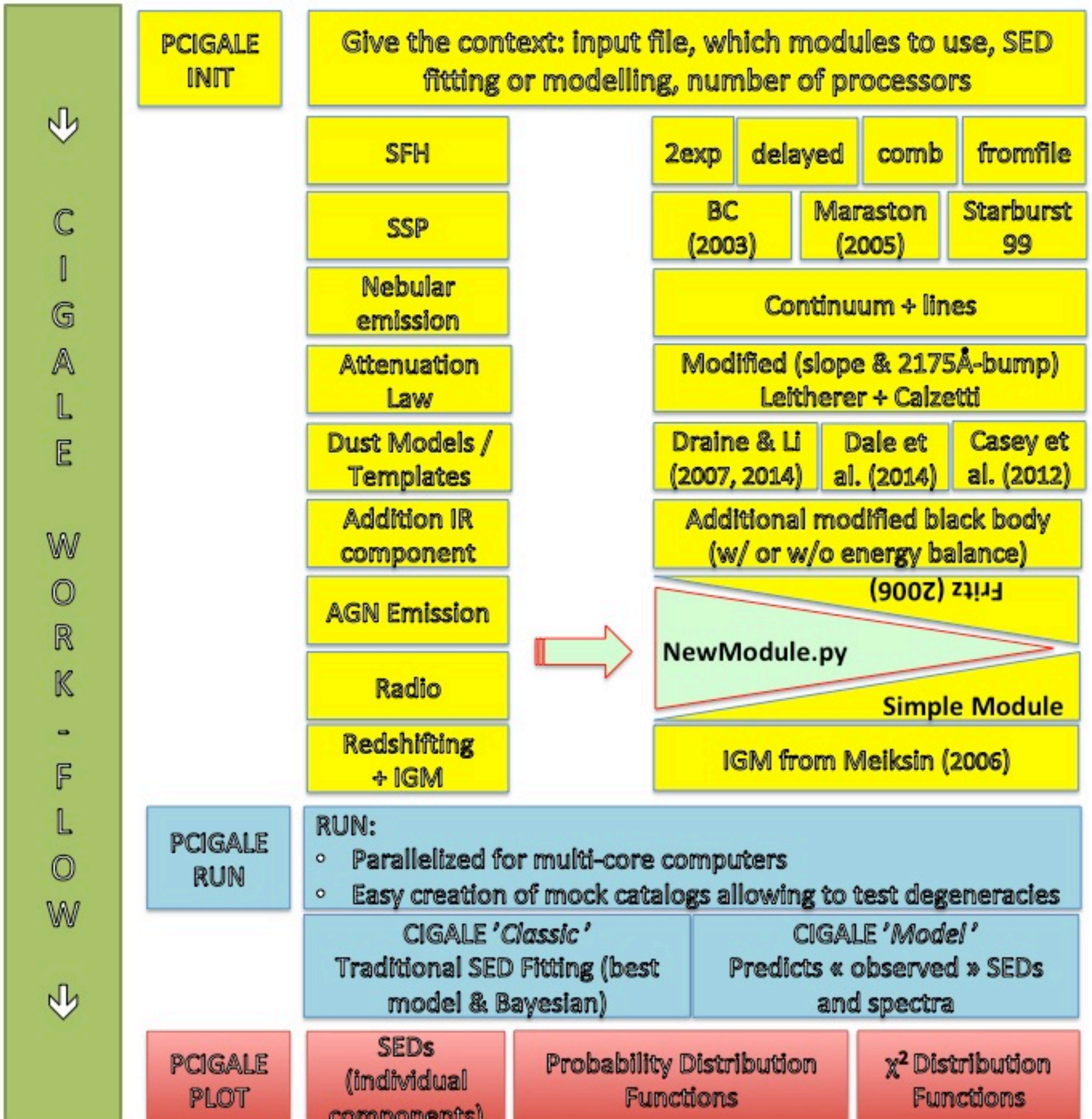
This configuration will give us **30** different bins to characterize the LBGs population at z~3 **as a function of L_{FUV}, β_{UV}, M_*, and the combination of (β_{UV}, M_*)**

Stacking as a function of M_* ($10.25 < \mathrm{Log}(M_*) < 10.5$)

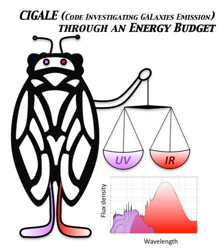


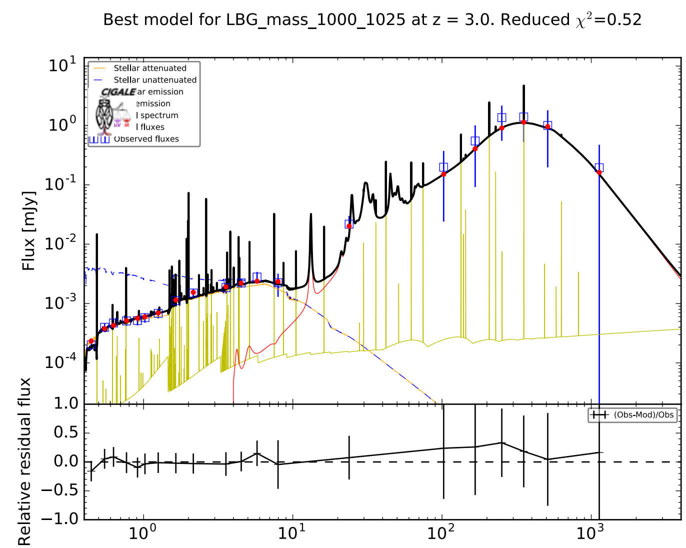


SED-fitting analysis: CIGALE



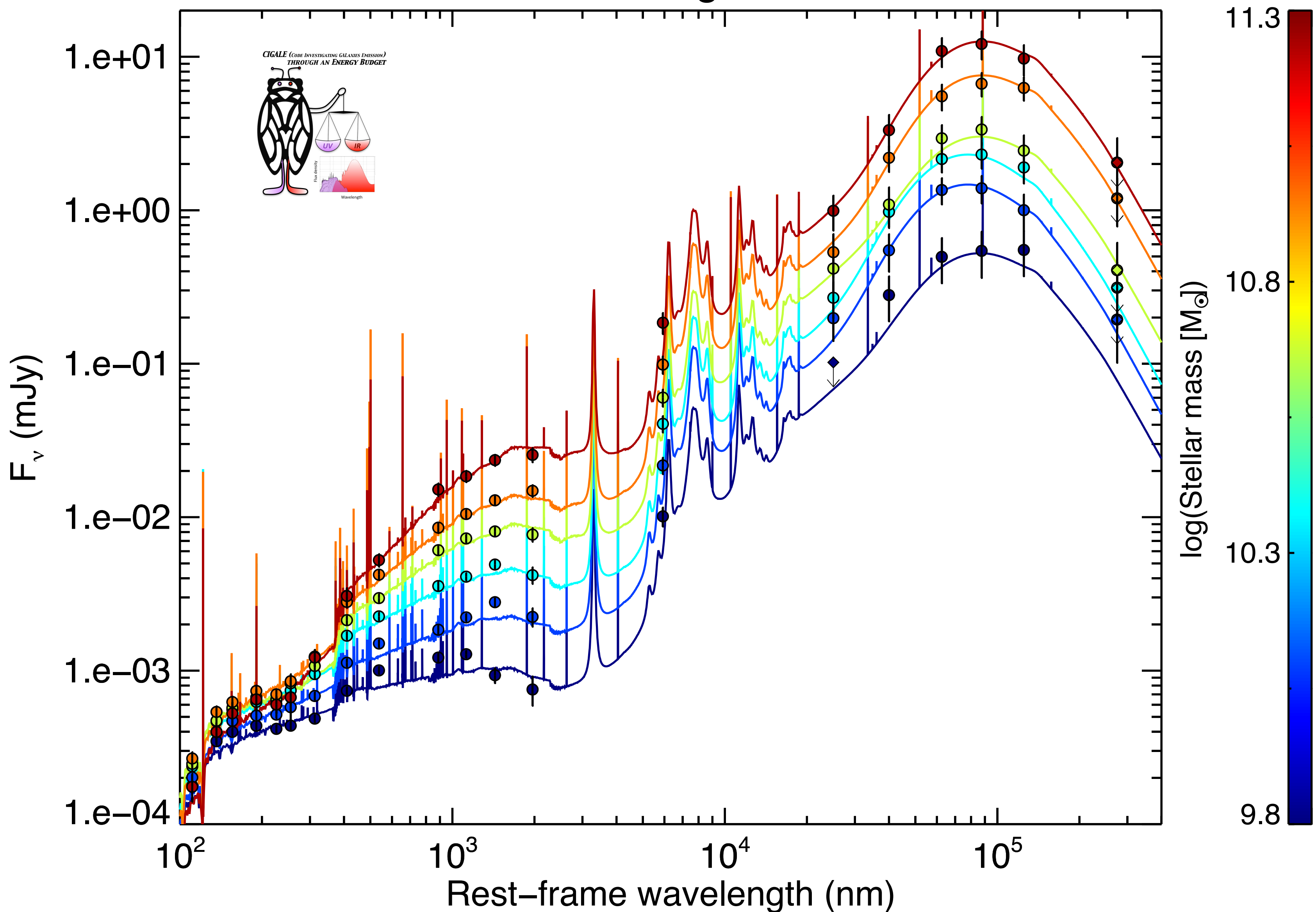
CIGALE is a self-consistent SED-fitting code designed to provide the main physical parameters of galaxies, by using Bayesian-like analysis and energy balance.



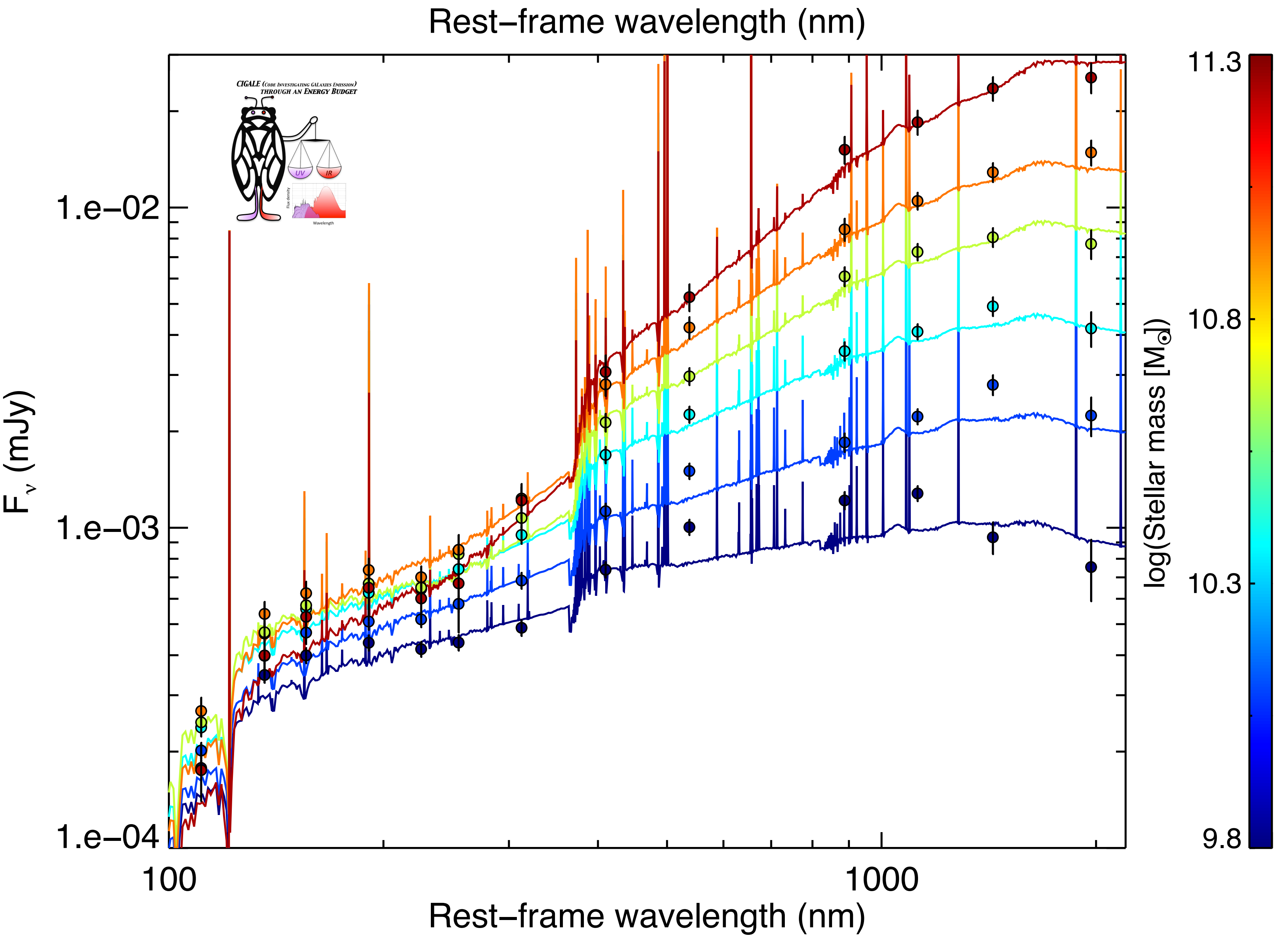


Stacked SEDs and SED-fitting results

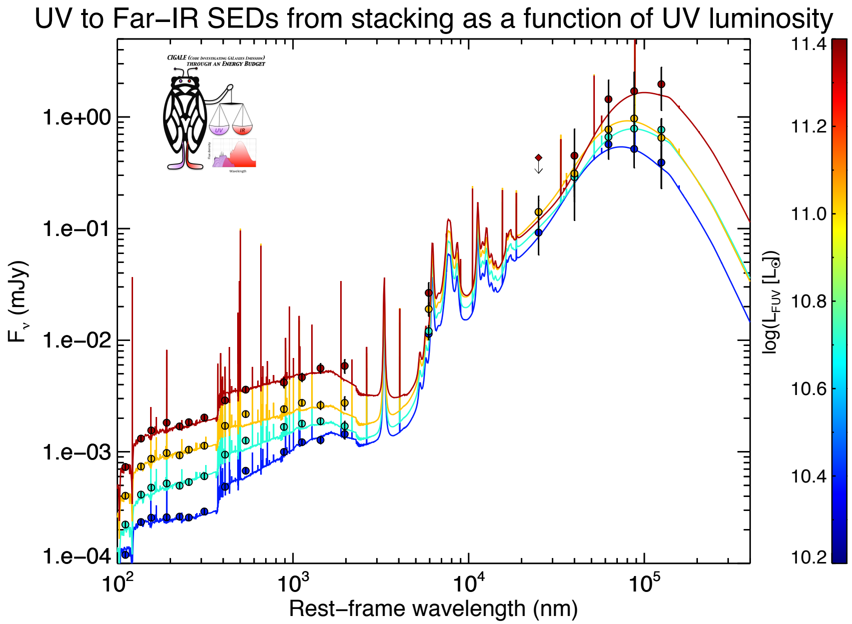
UV to Far−IR SEDs from stacking as a function of stellar mass

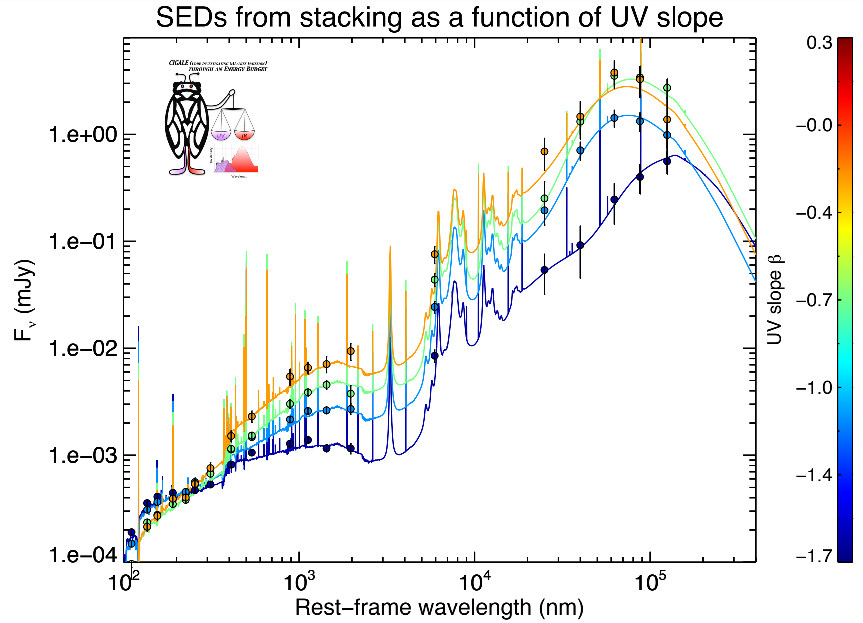


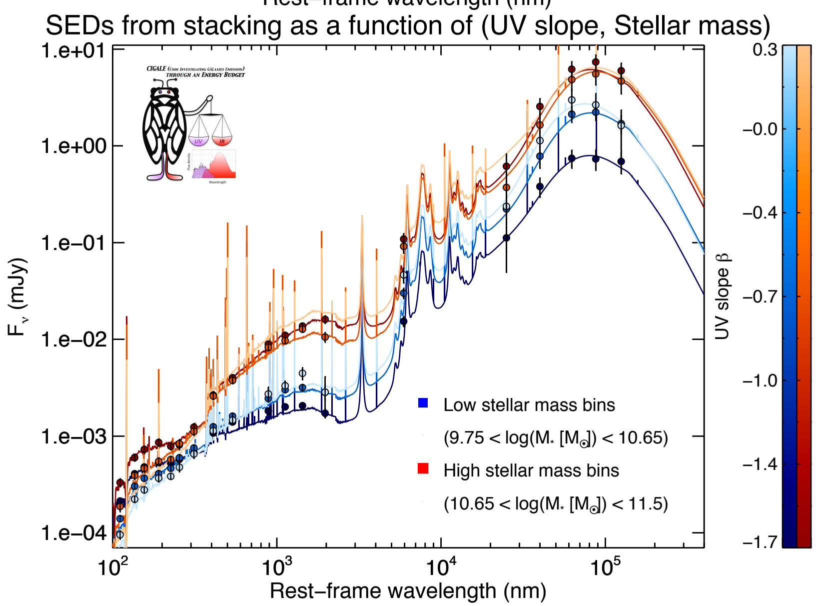
Stacked SEDs and SED-fitting results

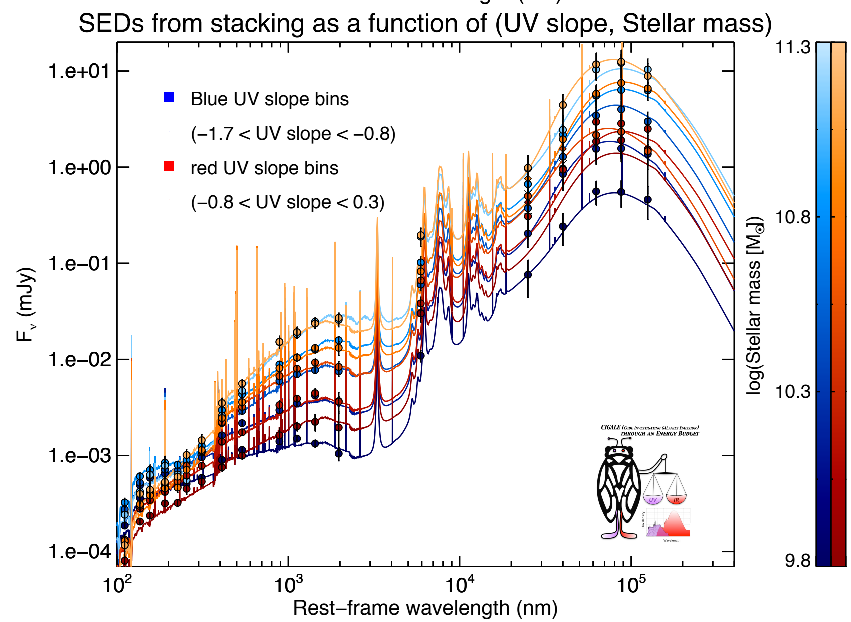


Stacked SEDs and SED-fitting results

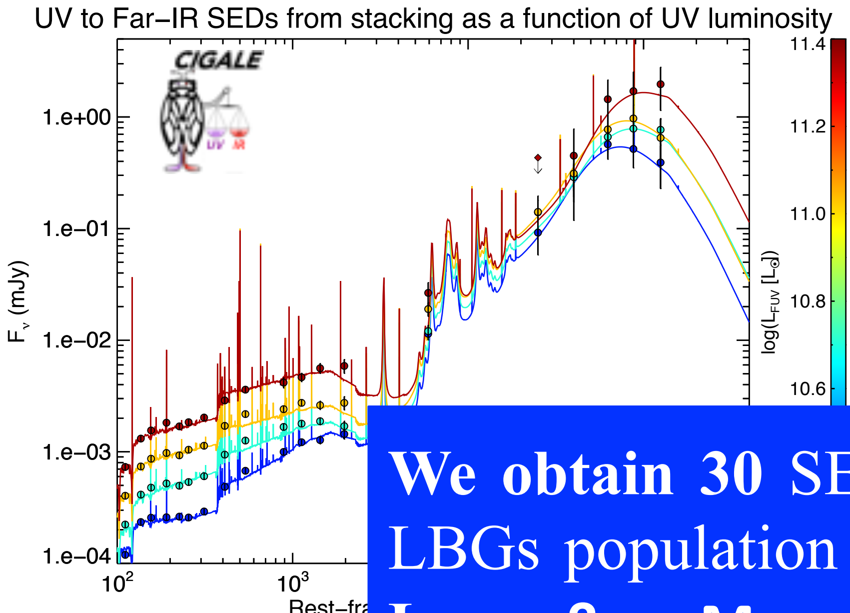


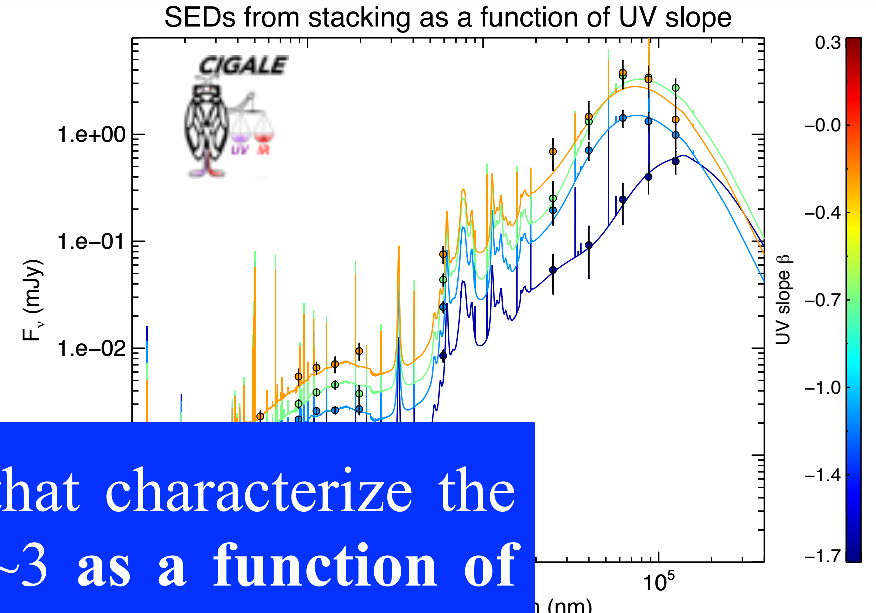


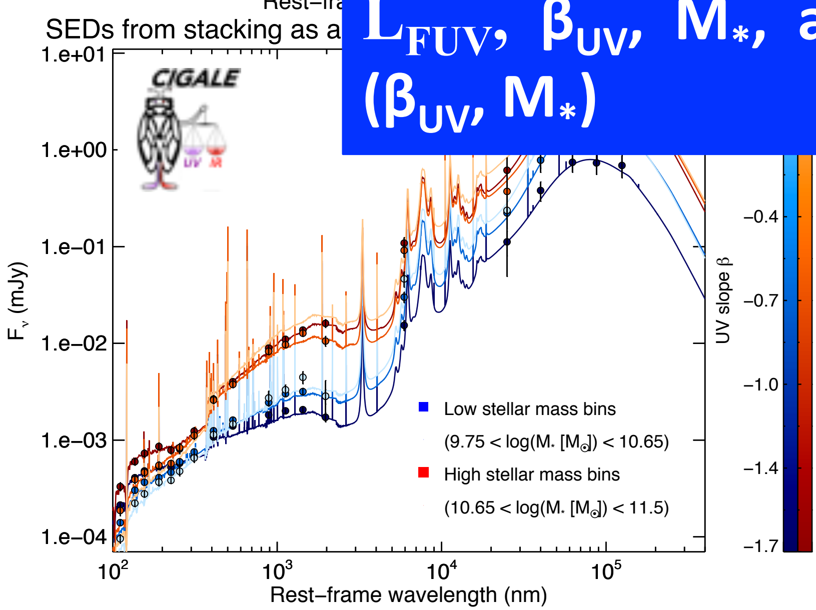


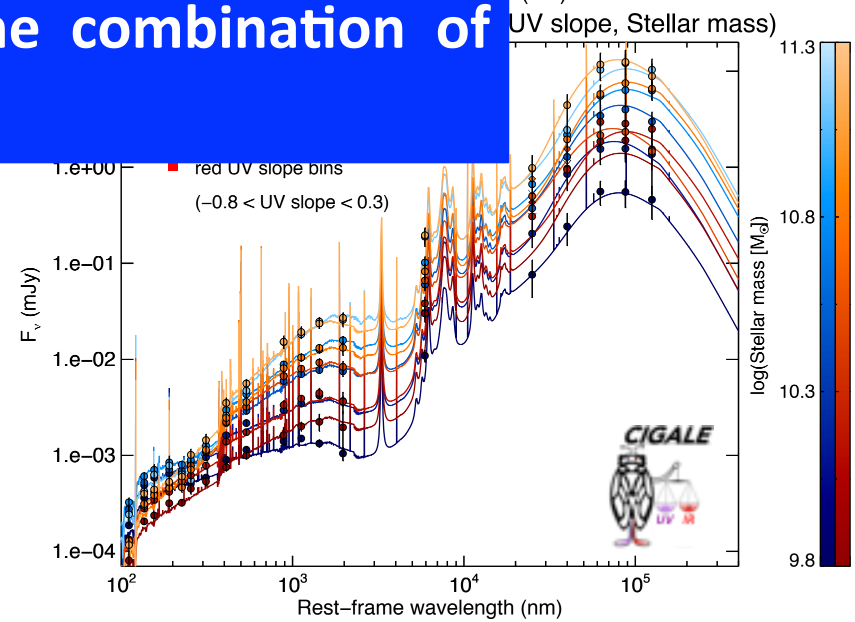


SEDs and SED-fitting analysis



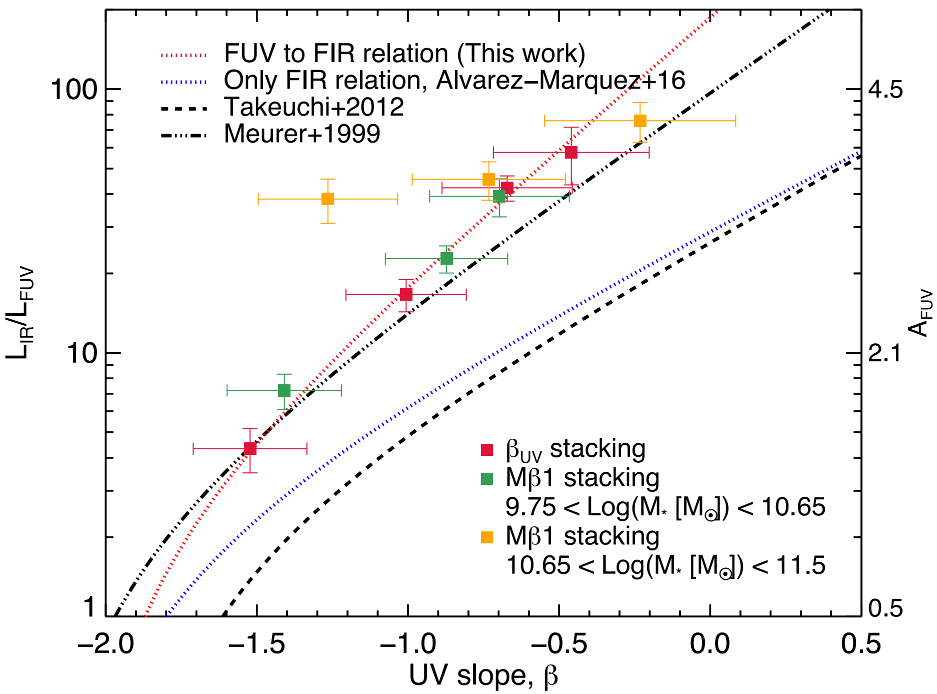


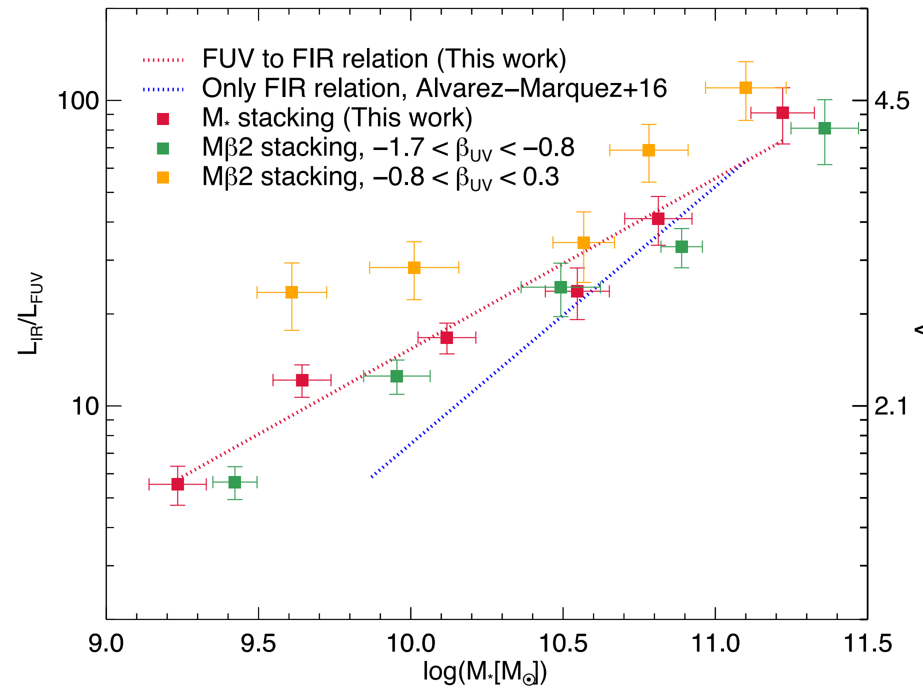




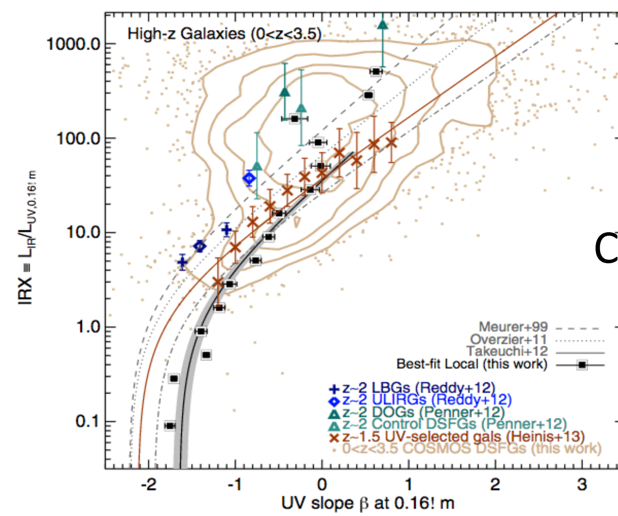
We obtain 30 SEDs that characterize the LBGs population at z~3 **as a function of** L_{FUV}, β_{UV}, M_*, **and the combination of** (β_{UV}, M_*)

Dust attenuation for LBGs at z~3



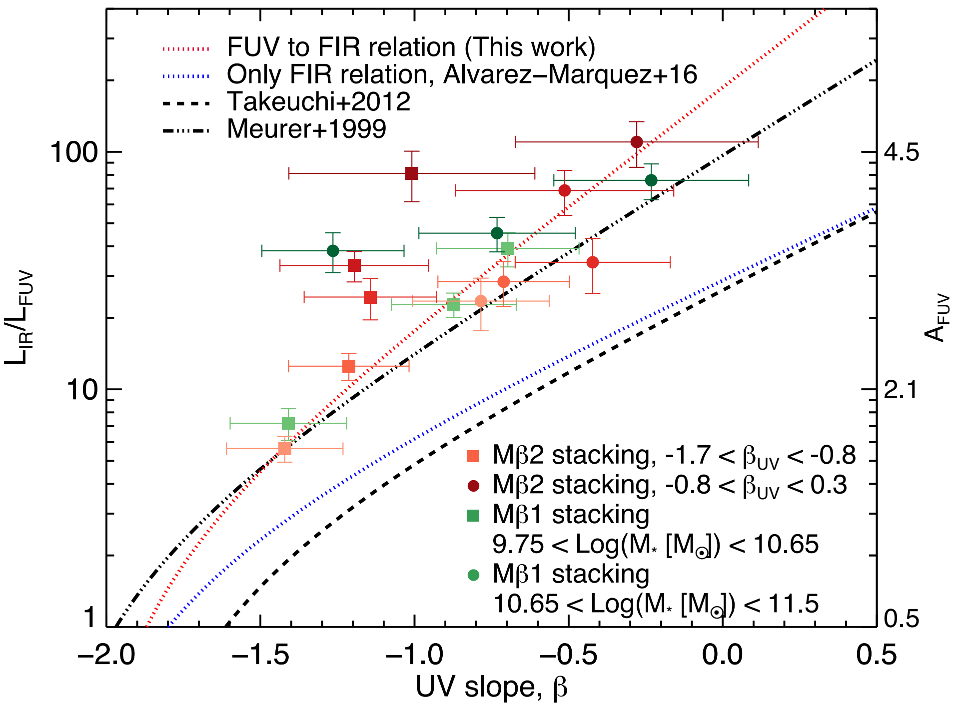


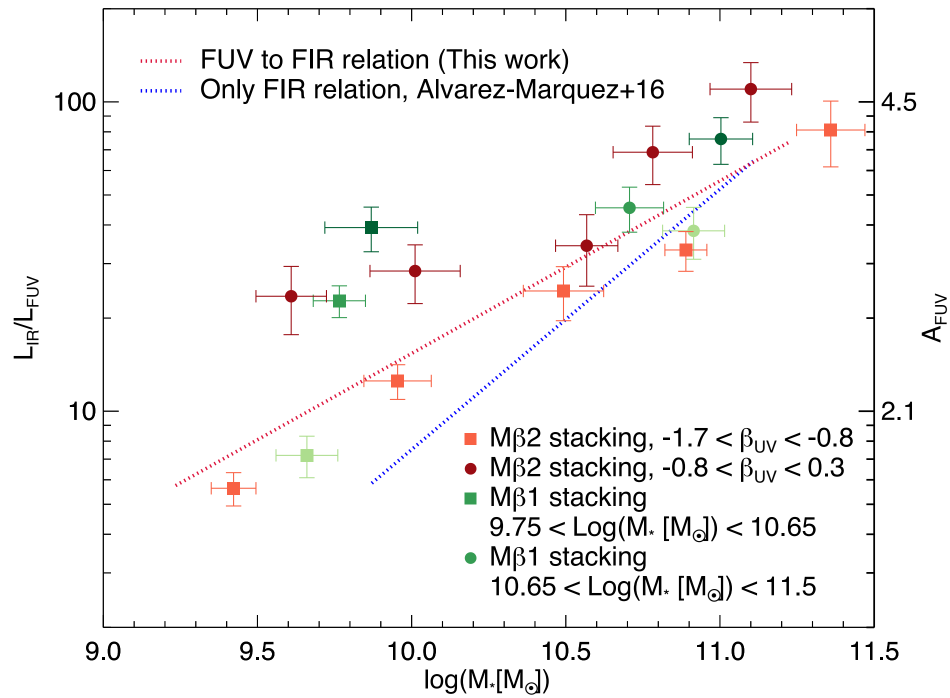
	Interval	Nº of bins
β_{UV}	-1.7 < β_{UV} < 0.3	4
M*	9.75 < log(M* [M⊙]) < 11.5	6
Mβ1	1: 9.75 < log(M* [M⊙]) < 10.65 2: 10.65 < log(M* [M⊙]) < 11.5	2 in M* 3 in β_{UV}
Mβ2	1: -1.7 < β_{UV} < -0.8 2: -0.8 < β_{UV} < 0.3	2 in β_{UV} 5 in M*



Casey+14

Dispersion on IRX-β_{UV} and IRX-M_* plane

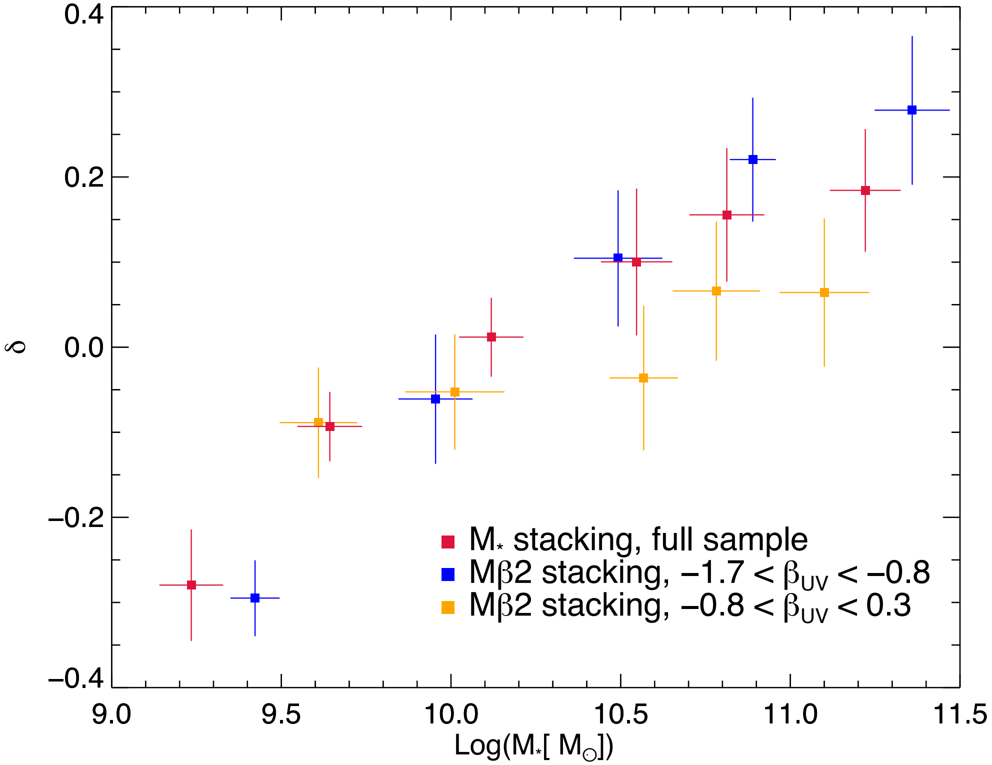




	Interval	Nº of bins
Mβ1	1: $9.75 < \log(M_* [M_\odot]) < 10.65$ 2: $10.65 < \log(M_* [M_\odot]) < 11.5$	2 in M_* 3 in β_{UV}
Mβ2	1: $-1.7 < \beta_{UV} < -0.8$ 2: $-0.8 < \beta_{UV} < 0.3$	2 in β_{UV} 5 in M_*

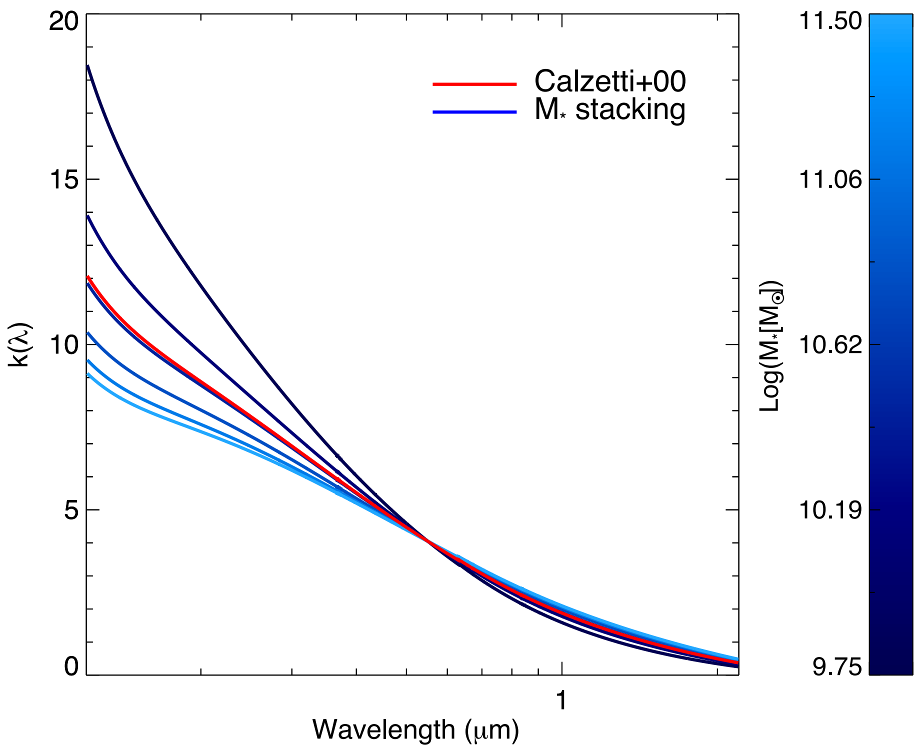
A combination of IRX, β_{UV}, and M_*, in a 3D plane, will presents the best combination to obtain the dust attenuation of a galaxy, this will break the dispersion in the IRX-β_{UV} and IRX-M_* plane (working in progress).

Shape of the dust attenuation curve for LBGs at z~3



SED-fitting analysis we focus to obtain the shape of the dust attenuation curve.

Modify Calzetti law (Noll+2009)



- The SED-fitting analysis suggest an evolution of the shape of the dust attenuation law as a function of the M*.

- **High mass – flatter than Calzetti+00**
- **Low M_* -- Steeper than Calzetti+00**

Next with JWST and Summary

JWST:

- NIRCam + MIRI will give access to the FUV to NIR spectrum domain at high-z (z~5-7), that will provide a possibility to calculate the shape of dust attenuation.
- Additional data of ALMA will give a self-consistent amount of dust attenuation (IRX or A_{FUV}) for this high-z galaxies.

Summary

We perform a stacking analysis using large sample of LBGs (20.000) from Optical to mm observation in the COSMOS field:

- We obtain 30 different SEDs for LBGs at z~3 as a function of LFUV, βUV, M*, and the combination of (βUV, M*).
- We present the mean dust attenuation as a function of βUV and M* for our LBGs population.
- We investigate the dispersion on the IRX-βUV and IRX-M* plane as a function of βUV and M*.
- Shape of dust attenuation evolve with the M*.