The MOSDEF Survey: Dissecting the SFR vs. M_* Relation at $z \sim 2$

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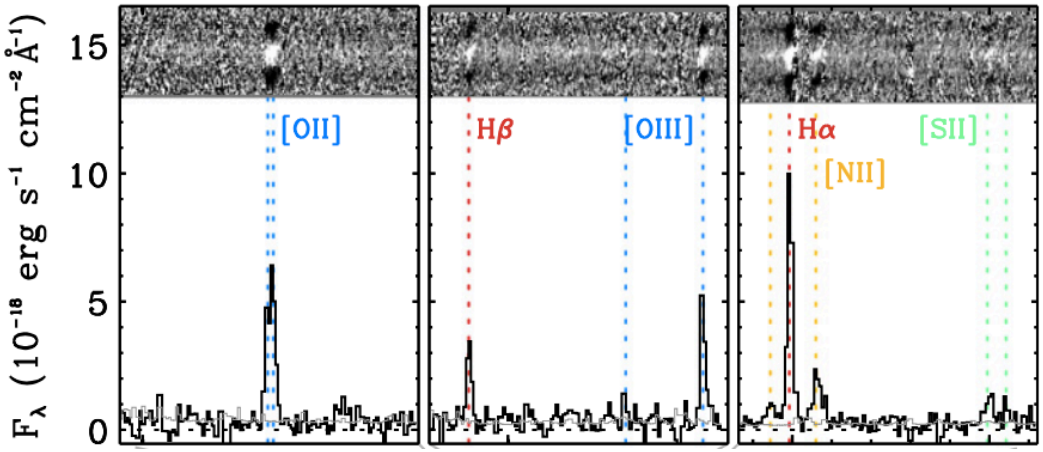
The MOSDEF* Survey

*MOSFIRE Deep Evolution Field

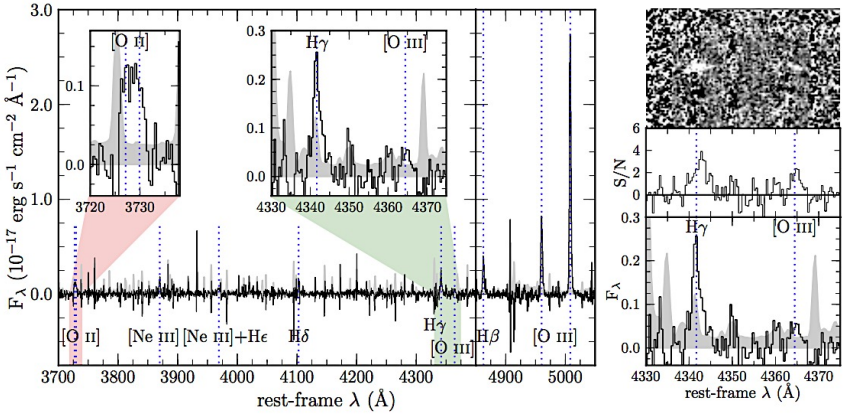


Kriek+2015

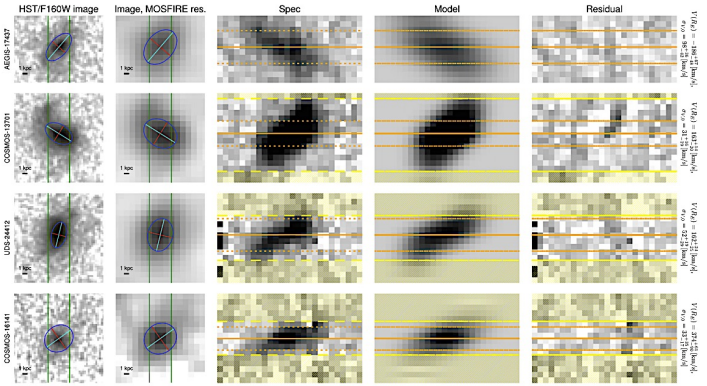
- Rest-frame optical spectra of ~ 1500 H-selected galaxies and AGNs
- 1.37 ≤ z ≤ 3.80
- CANDELS fields
- 48.5 nights with MOSFIRE on Keck I (2012-2016)
- Collaboration between UC Berkeley, UCLA, UC San Diego, UC Riverside

MOSDEF Recent Results

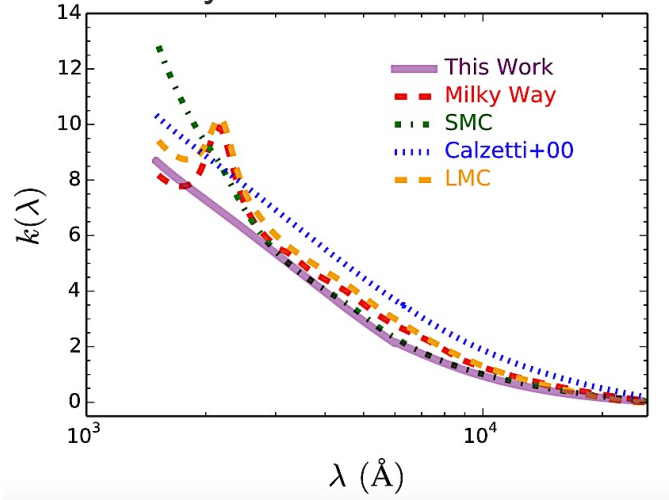
Sanders+2016



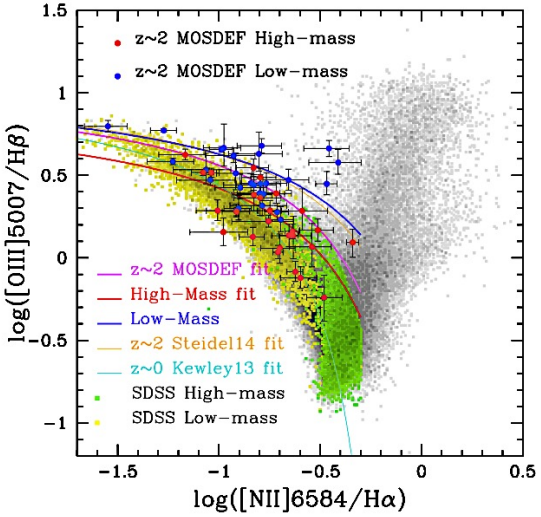
Price+2015



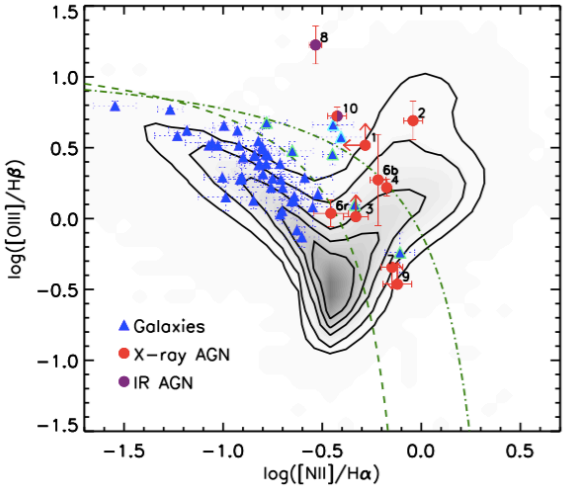
Reddy+2015



Shapley+2014

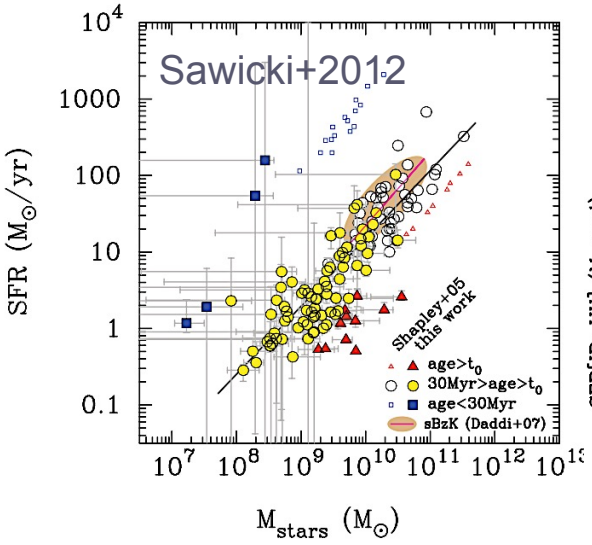


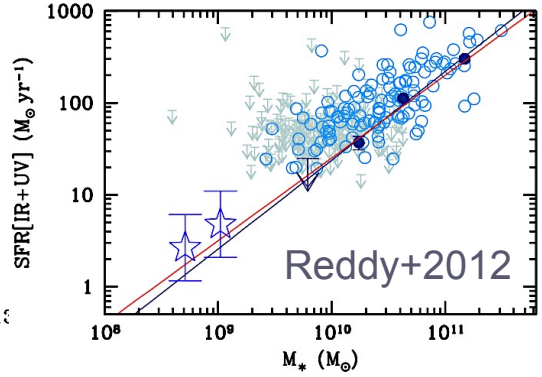
Coil+2014

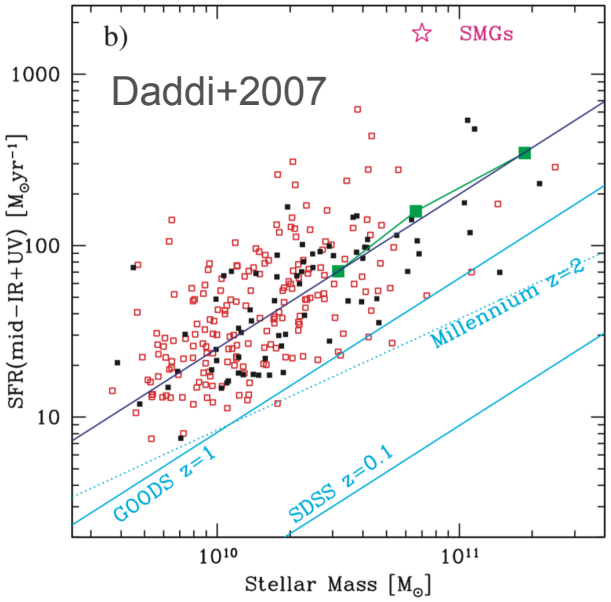


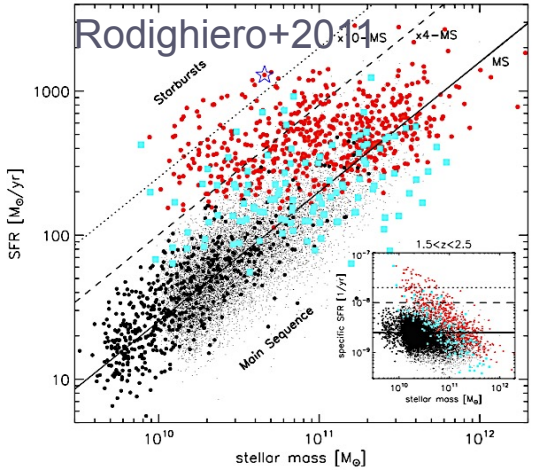
MOSDEF Survey: mosdef.astro.berkeley.edu

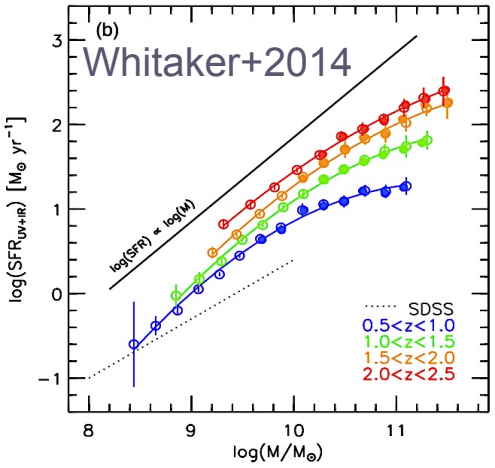
SFR-M* relation

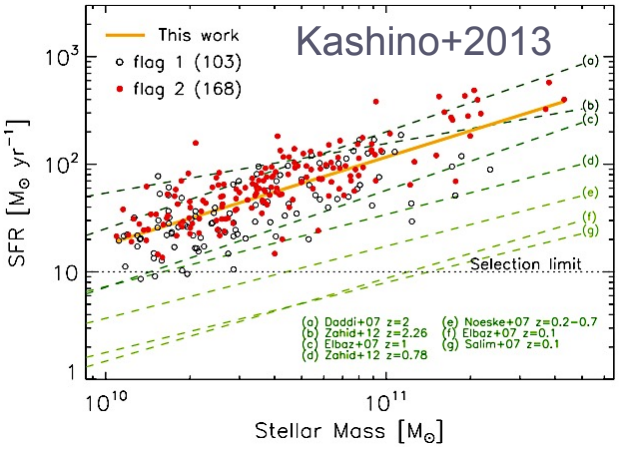






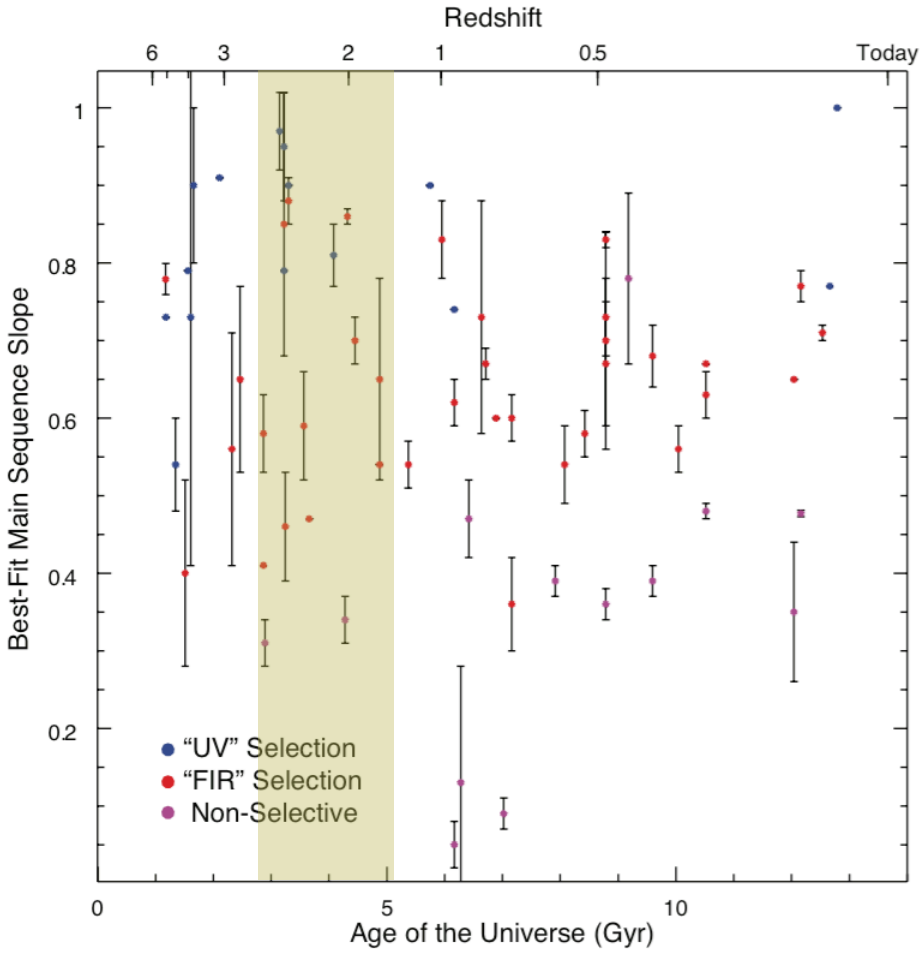






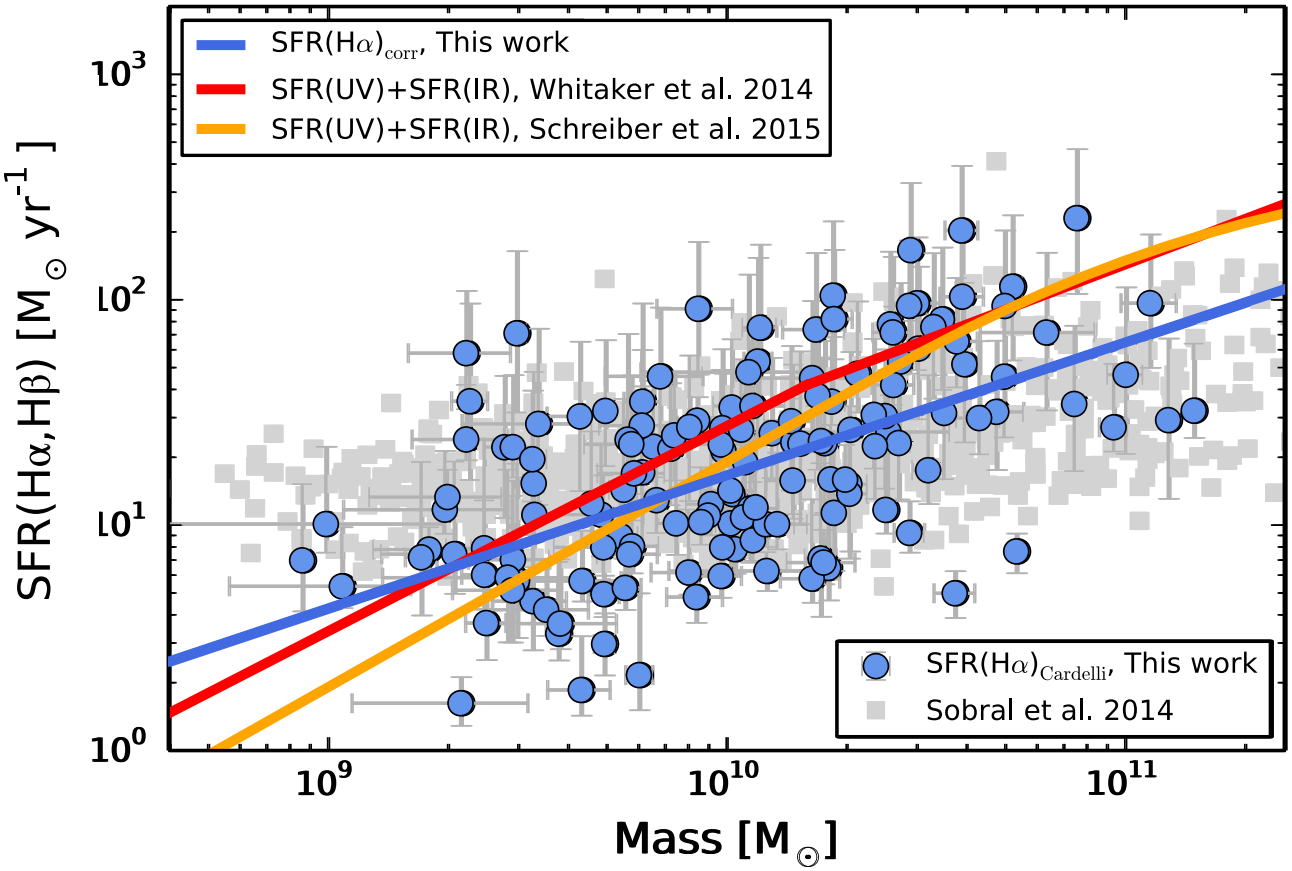
SFR-M* relation

- Discrepancy in the literature:
  slope ~ 0.3 – 1.0



Speagle+2014

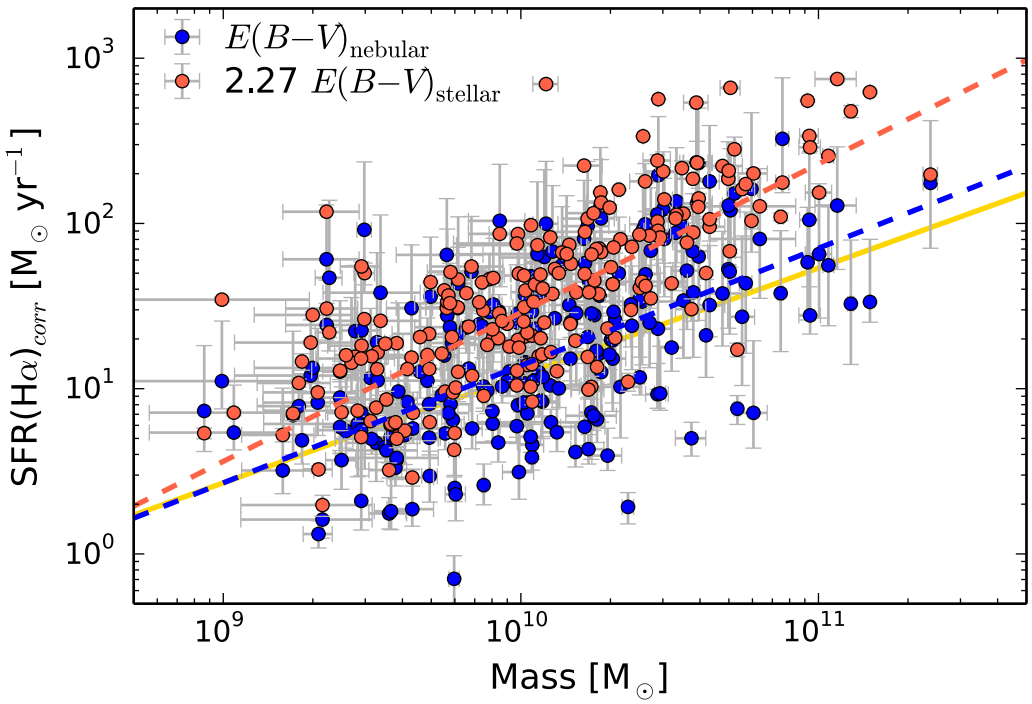
Slope = 0.58 ± 0.10 (z = 2.09 - 2.61)
0.65 ± 0.09 (z = 1.37 - 2.61)



Shivaei+2015b

- Discrepancy in the literature:
  slope ~ 0.3 – 1.0
- This study: 0.65 ± 0.09

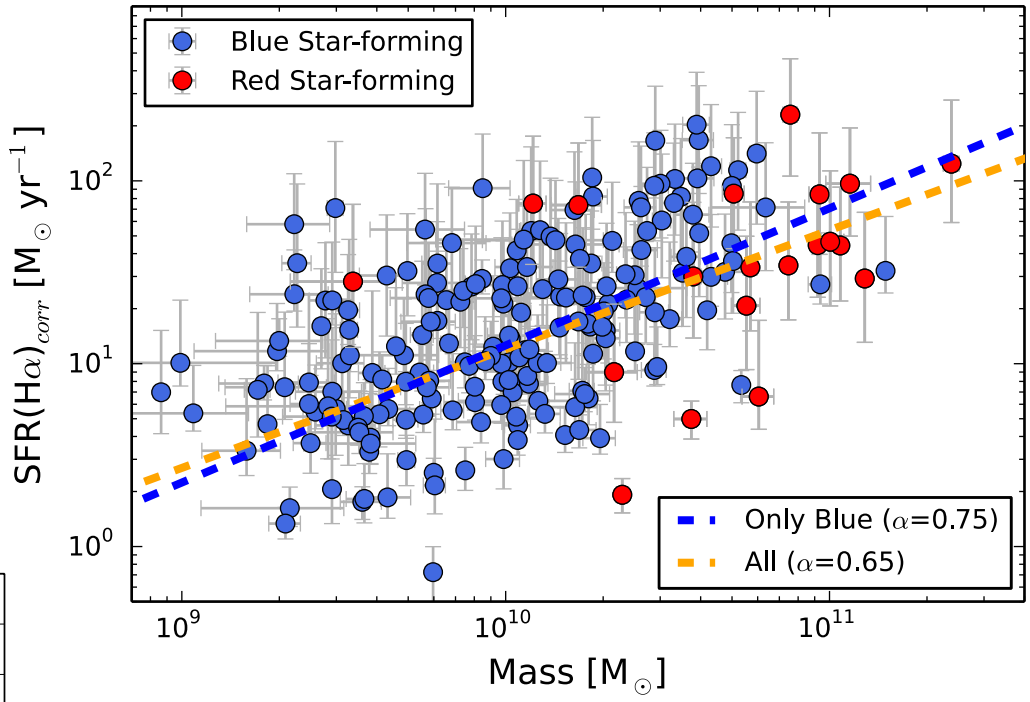
- Dust Correction

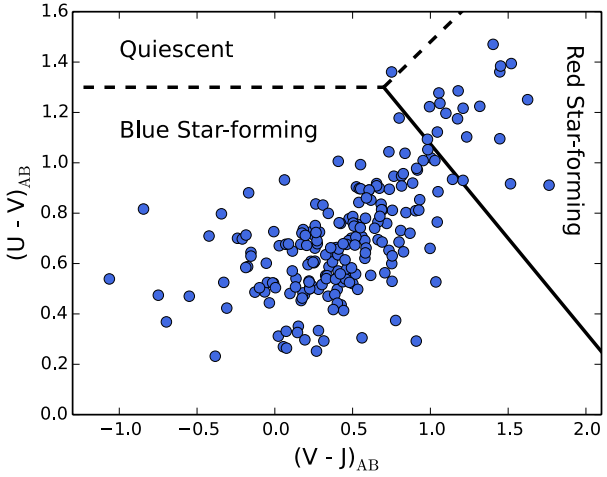


Shivaei+2015b

- Discrepancy in the literature: slope ~ 0.3 – 1.0
- This study: 0.65 ± 0.09

- Dust Correction
- Sample biases

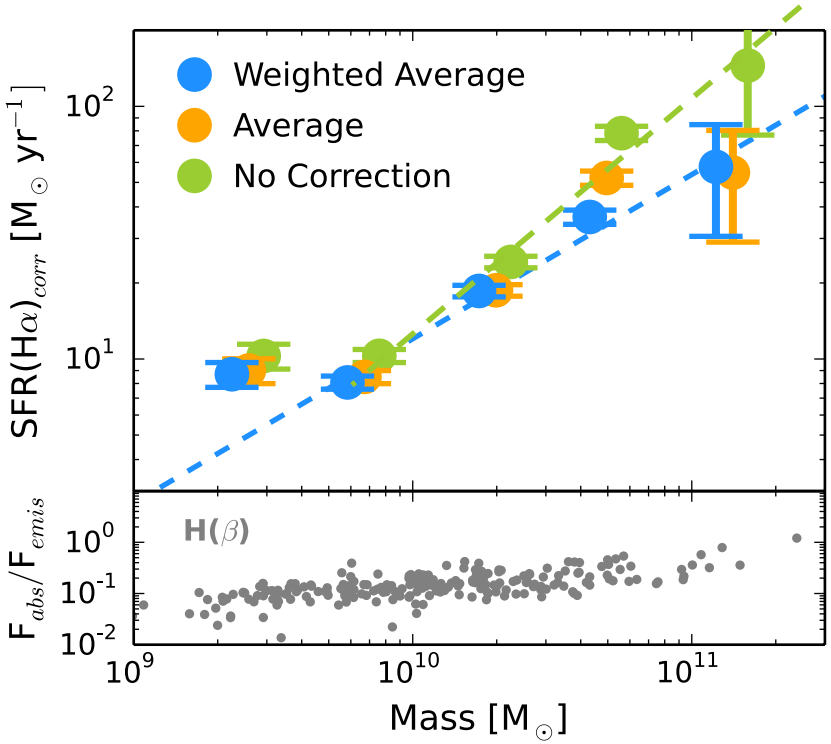




Shivaei+2015b

- Discrepancy in the literature:
  slope ~ 0.3 – 1.0
- This study: 0.65 ± 0.09

- Dust Correction
- Sample biases
- Absorption Correction

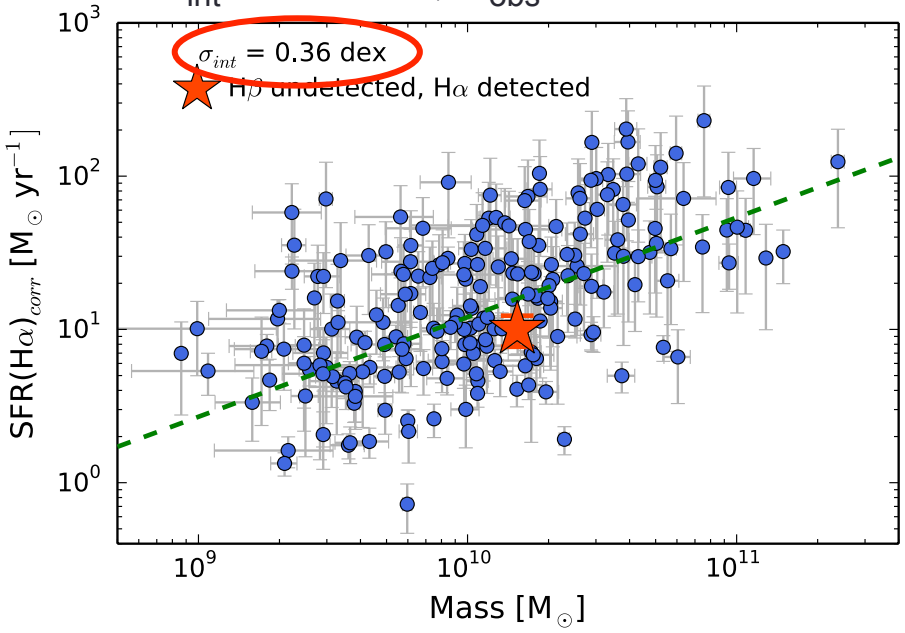


Shivaei+2015b

The SFR Scatter

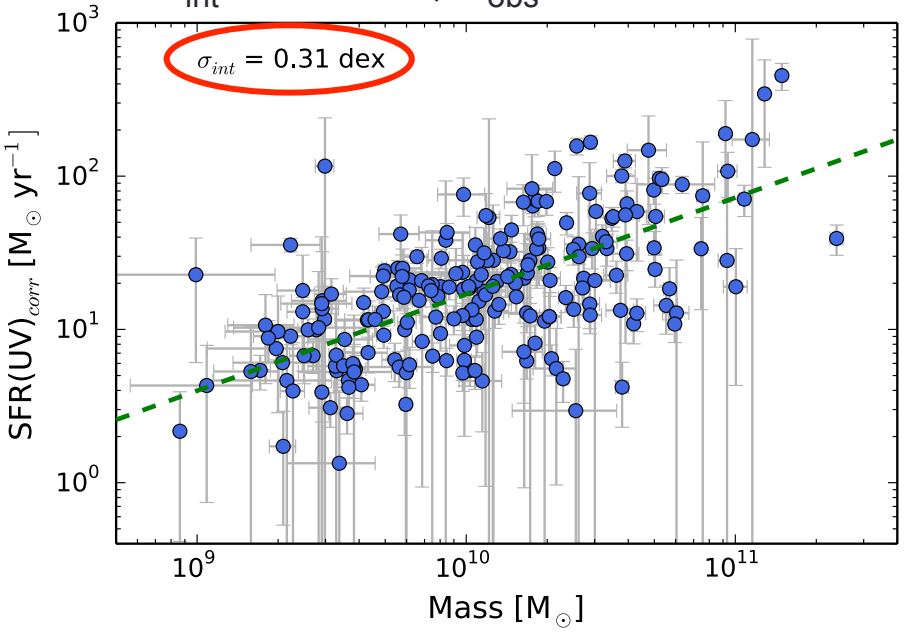
SFR(Hα,Hβ): O type stars

σ_{int}=0.36 dex, σ_{obs}=0.40 dex



SFR(UV): O and B type stars

σ_{int}=0.31 dex, σ_{obs}=0.36 dex



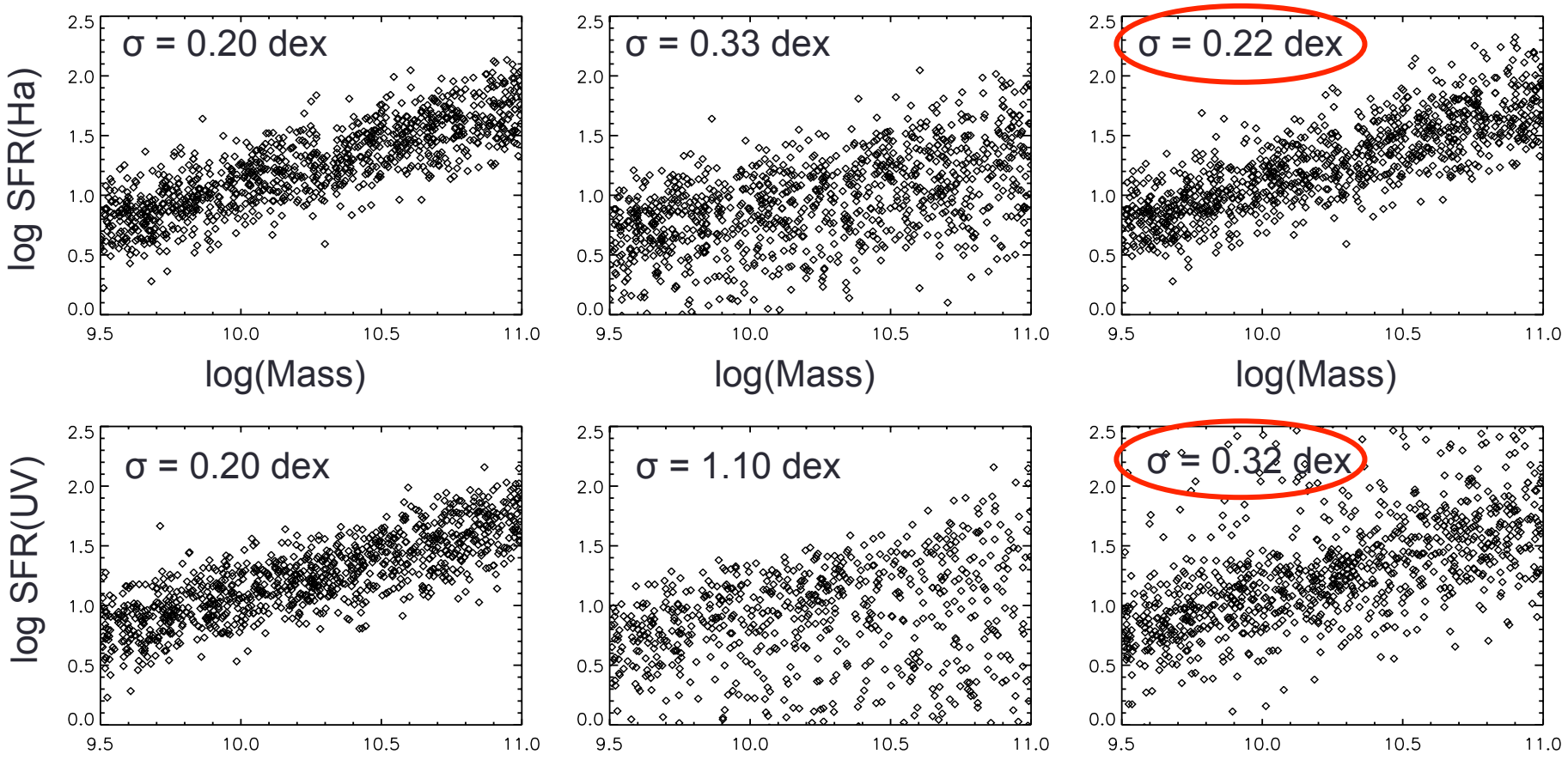
Galaxy-to-galaxy variations in:

- Dust attenuation curve
- IMF

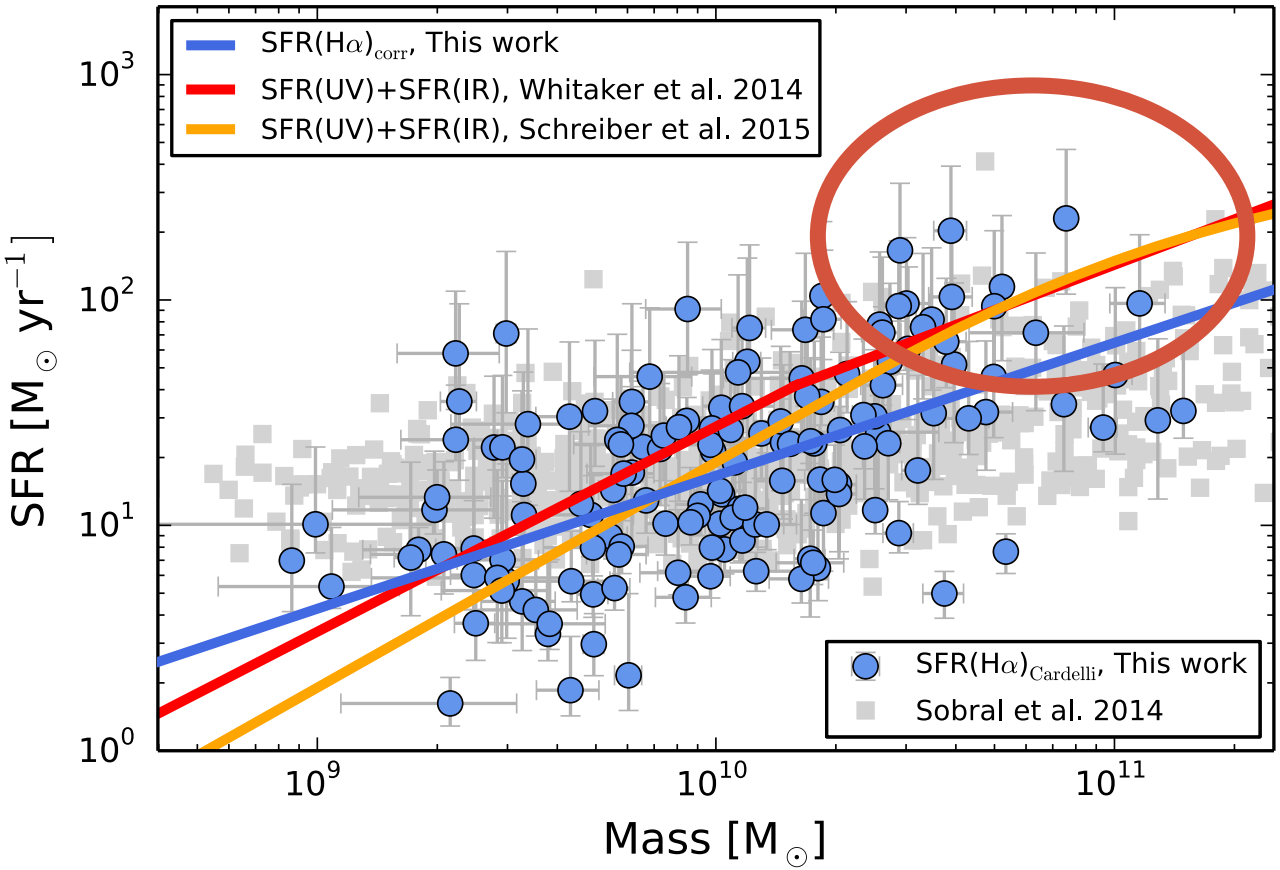
Shivaei+2015b

Galaxy-to-galaxy variations in attenuation curve

Simulated → Attenuated, assuming different attenuation curves → Dust-corrected, assuming a single attenuation curve

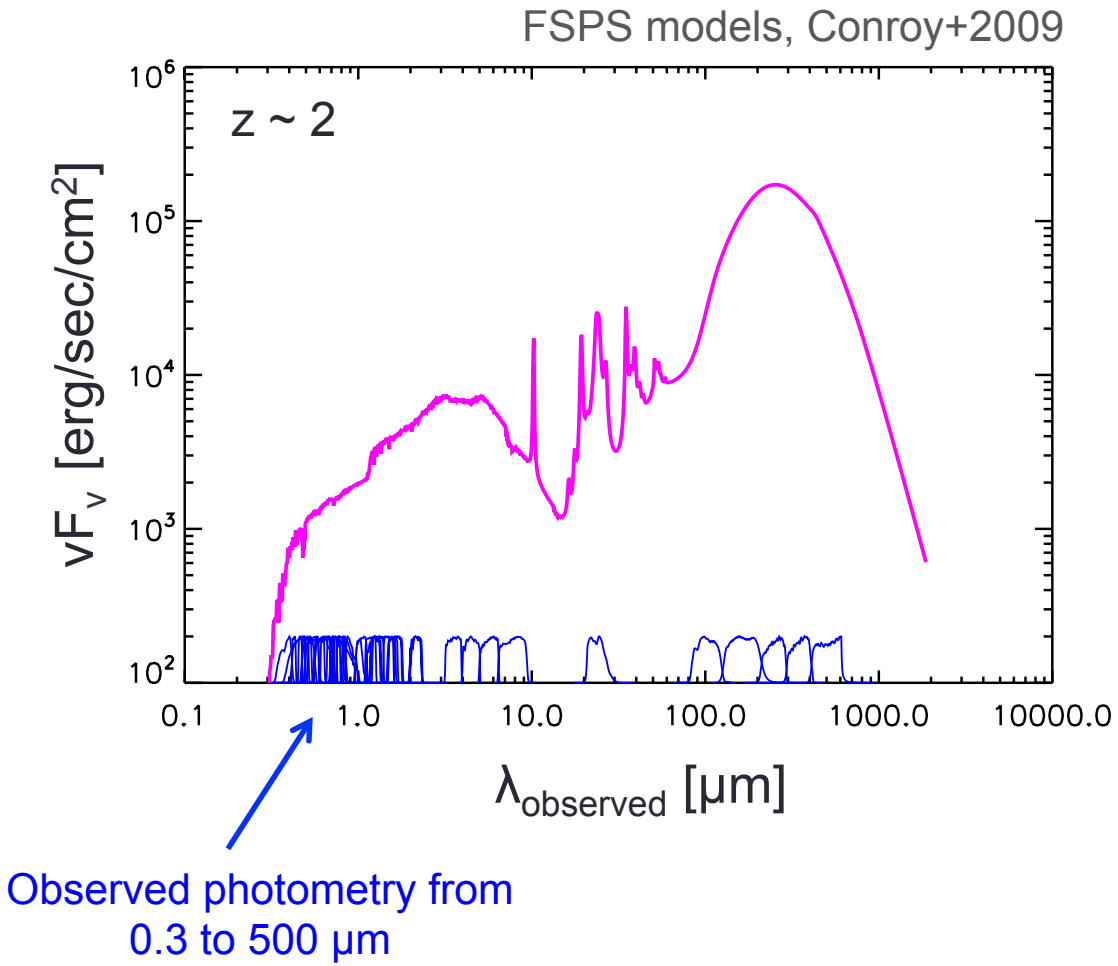


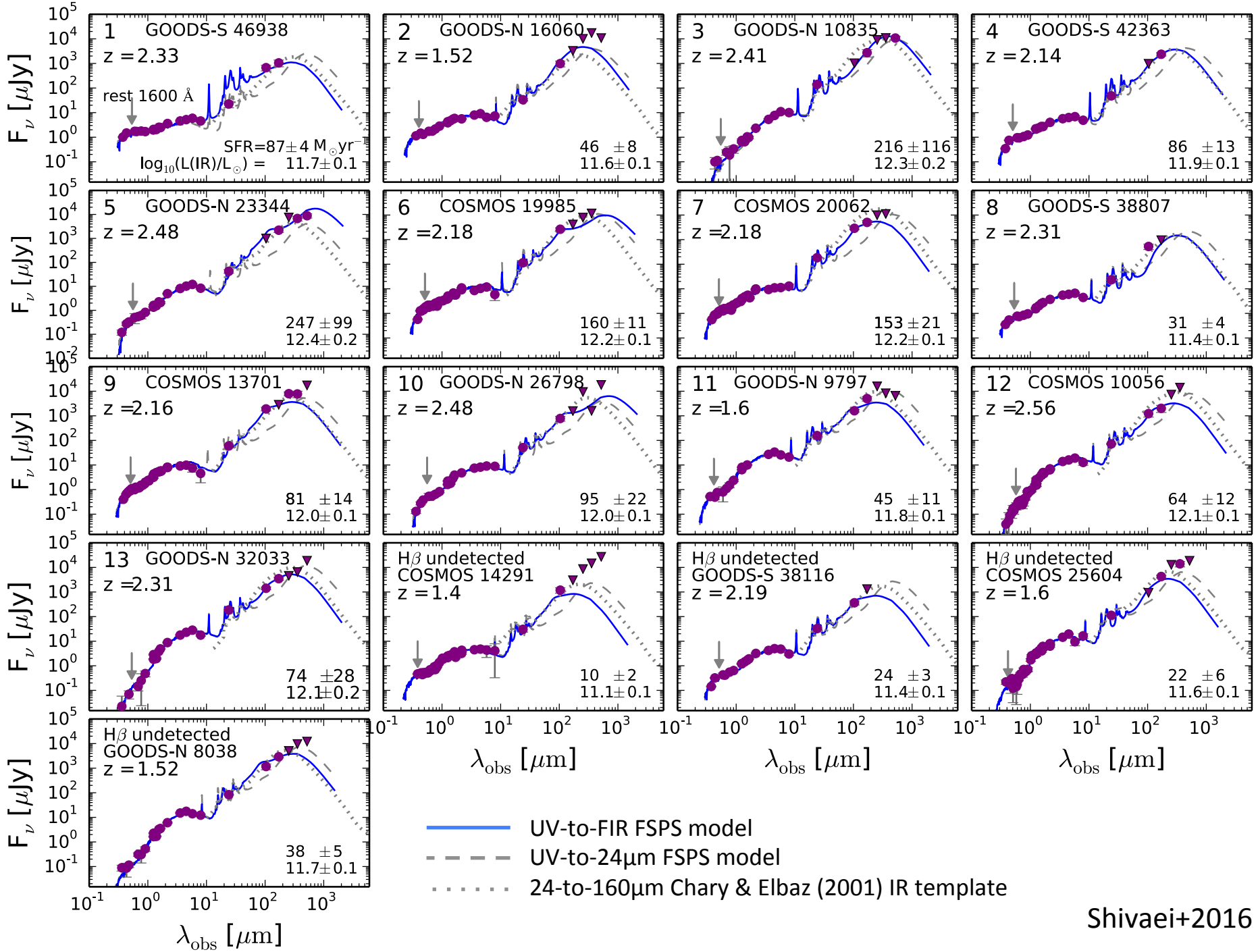
Are Hα and Hβ good tracers of SFR?

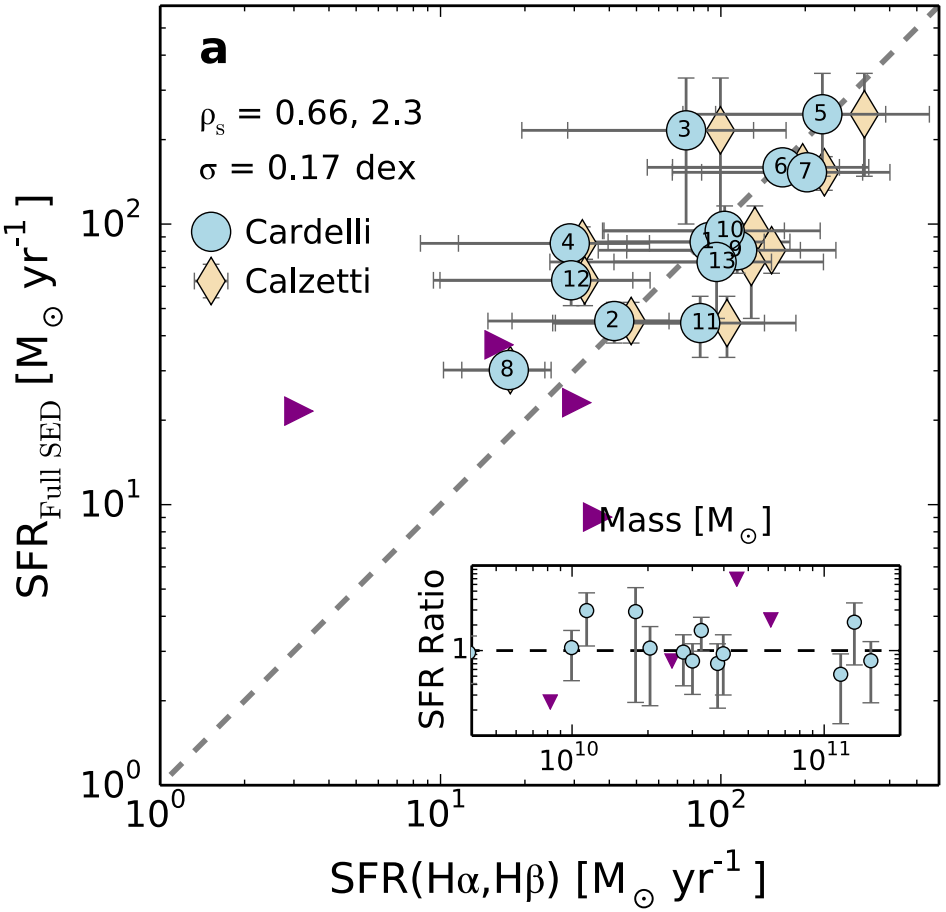


Shivaei+2015b

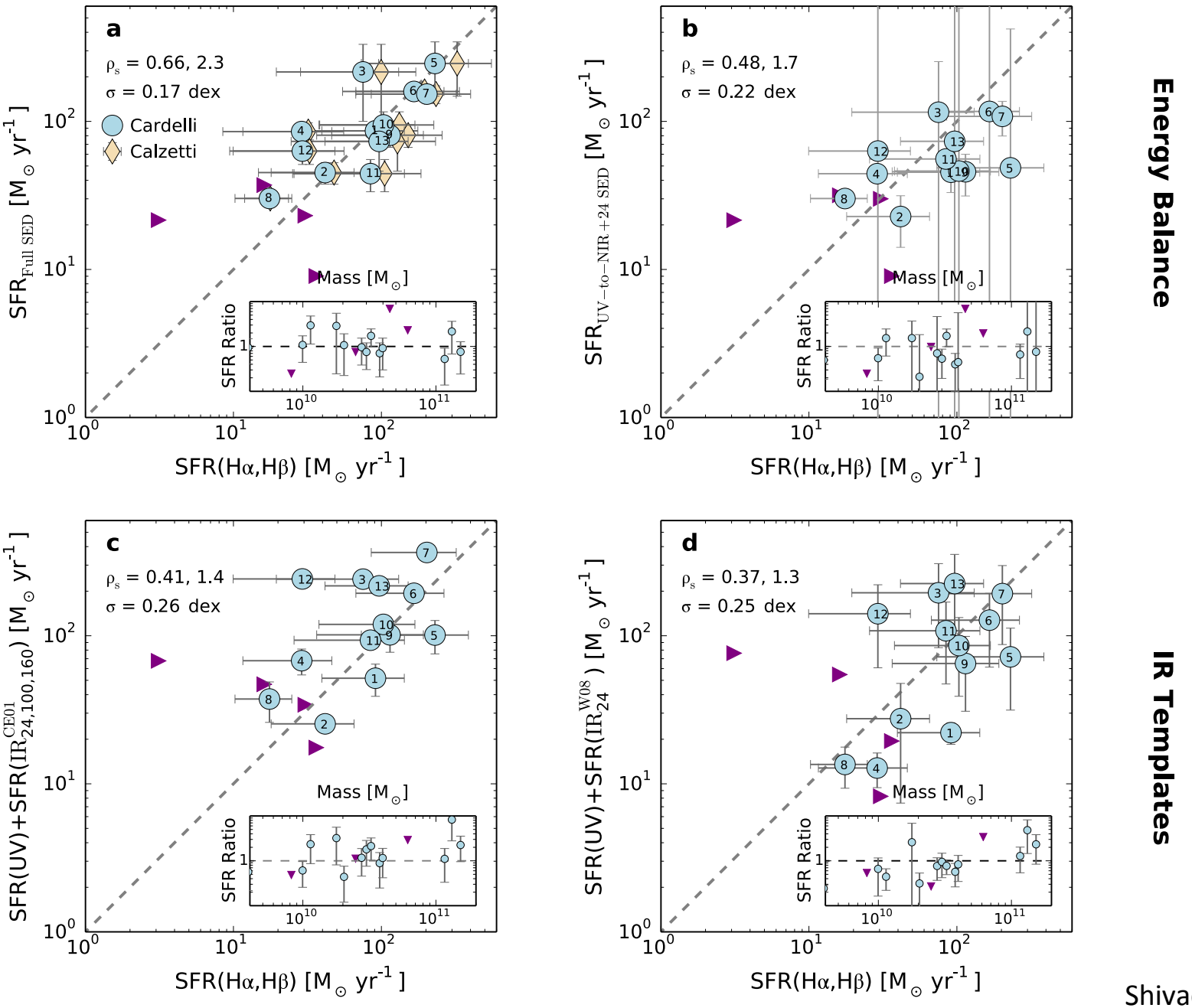
Panchromatic SED Modeling




1 GOODS-S 46938
z = 2.33
rest 1600 Å
SFR=87±4 M⊙yr⁻¹
log10(L(IR)/L⊙) = 11.7±0.1
2 GOODS-N 16060
z = 1.52
46 ±8
11.6±0.1
3 GOODS-N 10835
z = 2.41
216 ±116
12.3±0.2
4 GOODS-S 42363
z = 2.14
86 ±13
11.9±0.1
5 GOODS-N 23344
z = 2.48
247 ±99
12.4±0.2
6 COSMOS 19985
z = 2.18
160 ±11
12.2±0.1
7 COSMOS 20062
z = 2.18
153 ±21
12.2±0.1
8 GOODS-S 38807
z = 2.31
31 ±4
11.4±0.1
9 COSMOS 13701
z = 2.16
81 ±14
12.0±0.1
10 GOODS-N 26798
z = 2.48
95 ±22
12.0±0.1
11 GOODS-N 9797
z = 1.6
45 ±11
11.8±0.1
12 COSMOS 10056
z = 2.56
64 ±12
12.1±0.1
13 GOODS-N 32033
z = 2.31
74 ±28
12.1±0.2
Hβ undetected
COSMOS 14291
z = 1.4
10 ±2
11.1±0.1
Hβ undetected
GOODS-S 38116
z = 2.19
24 ±3
11.4±0.1
Hβ undetected
COSMOS 25604
z = 1.6
22 ±6
11.6±0.1
Hβ undetected
GOODS-N 8038
z = 1.52
38 ±5
11.7±0.1
Fν [μJy]
λobs [μm]
UV-to-FIR FSPS model
UV-to-24μm FSPS model
24-to-160μm Chary & Elbaz (2001) IR template
Shivaei+2016

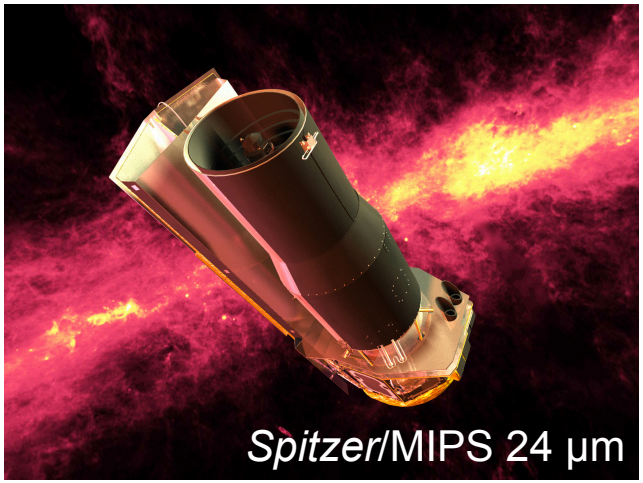


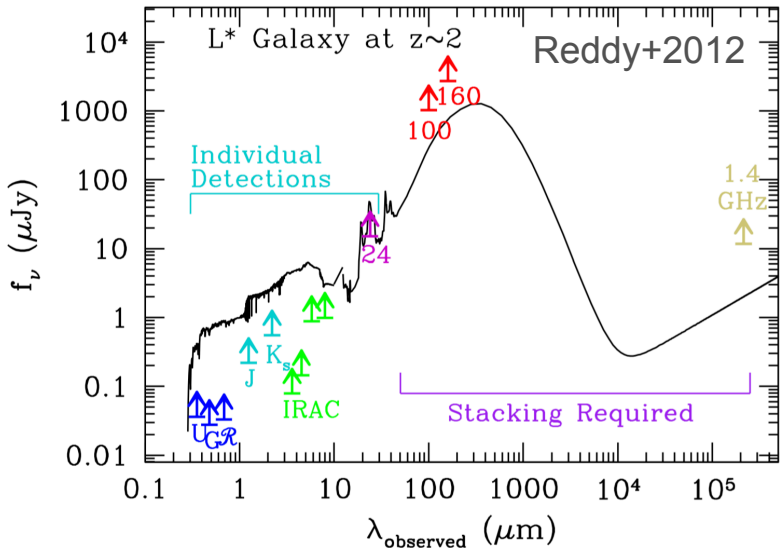
Shivaei+2016



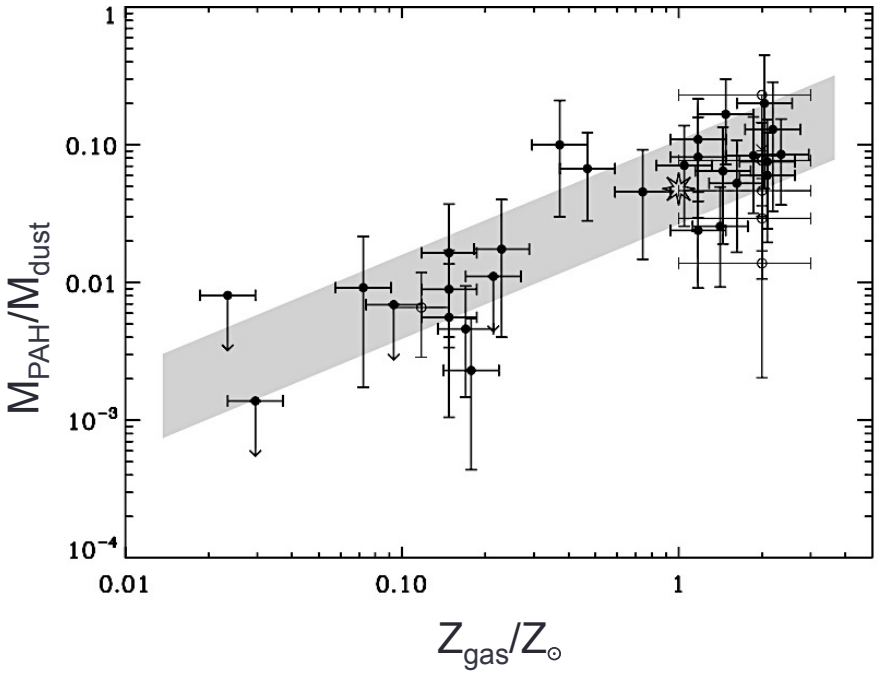
Shivaei+2016

Is 8μm a good tracer of SFR?





Galliano+2008



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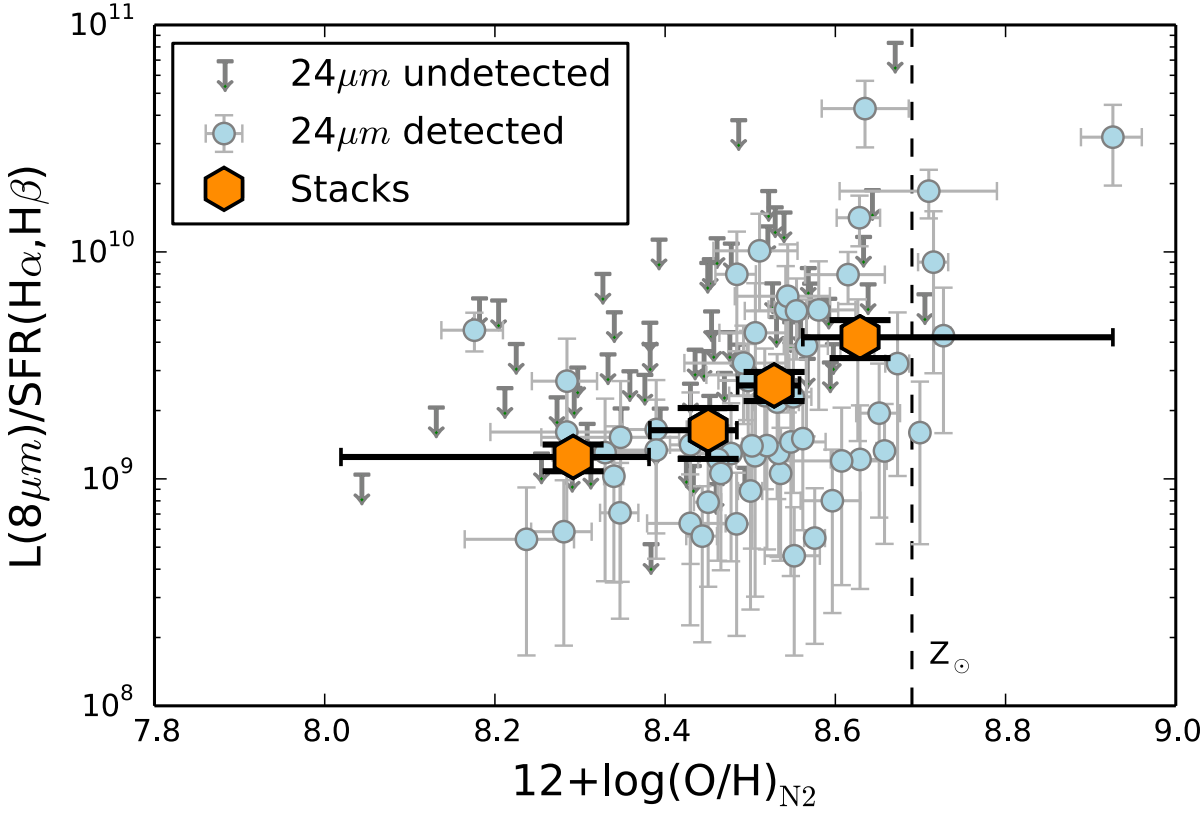

Strength of 8μm luminosity for a given SFR is metallicity-dependent

Shivaei et al., in prep

Summary

- Using the MOSDEF Hα and Hβ spectroscopic data, we **constrain the slope and scatter of the SFR-M_* relation** for star-forming galaxies at $z \sim 2$ *(Shivaei+2015b)*
  - demonstrate the effect of various observational biases on the slope
  - slope = 0.65 ± 0.09, scatter = 0.36 dex (z = 1.37 - 2.61)
- Even at high SFRs, **dust-corrected Hα luminosity,** using Balmer decrement, **is an accurate tracer of SFR** *(Shivaei+2016)*
  - for star-forming galaxies at $z \sim 2$ with SFRs up to $\sim 200\ M_\odot\ yr^{-1}$
- **Rest-frame 8μm luminosity is strongly dependent on metallicity** and should be treated with caution as a SFR and total IR luminosity estimator *(Shivaei+, in prep)*

MOSDEF Survey: mosdef.astro.berkeley.edu


Thank you!