Mocks with [OII] emitters

Violeta Gonzalez-Perez

and Ginevra Favole (ESAC), Santiago Ávila(Madrid),
Johan Comparat (MPE), Weiguang Cui (Edingburgh),
and other collaborators

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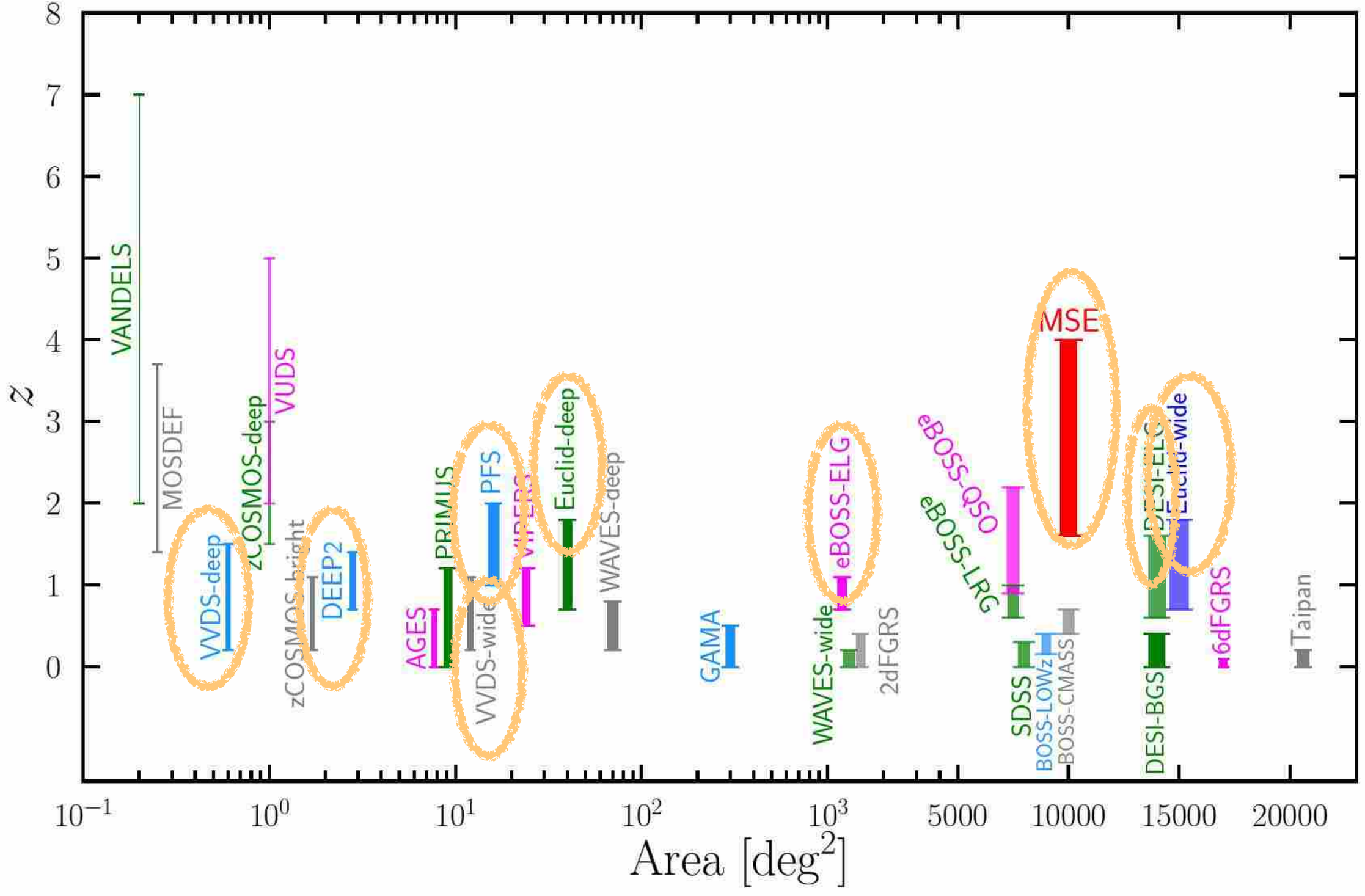
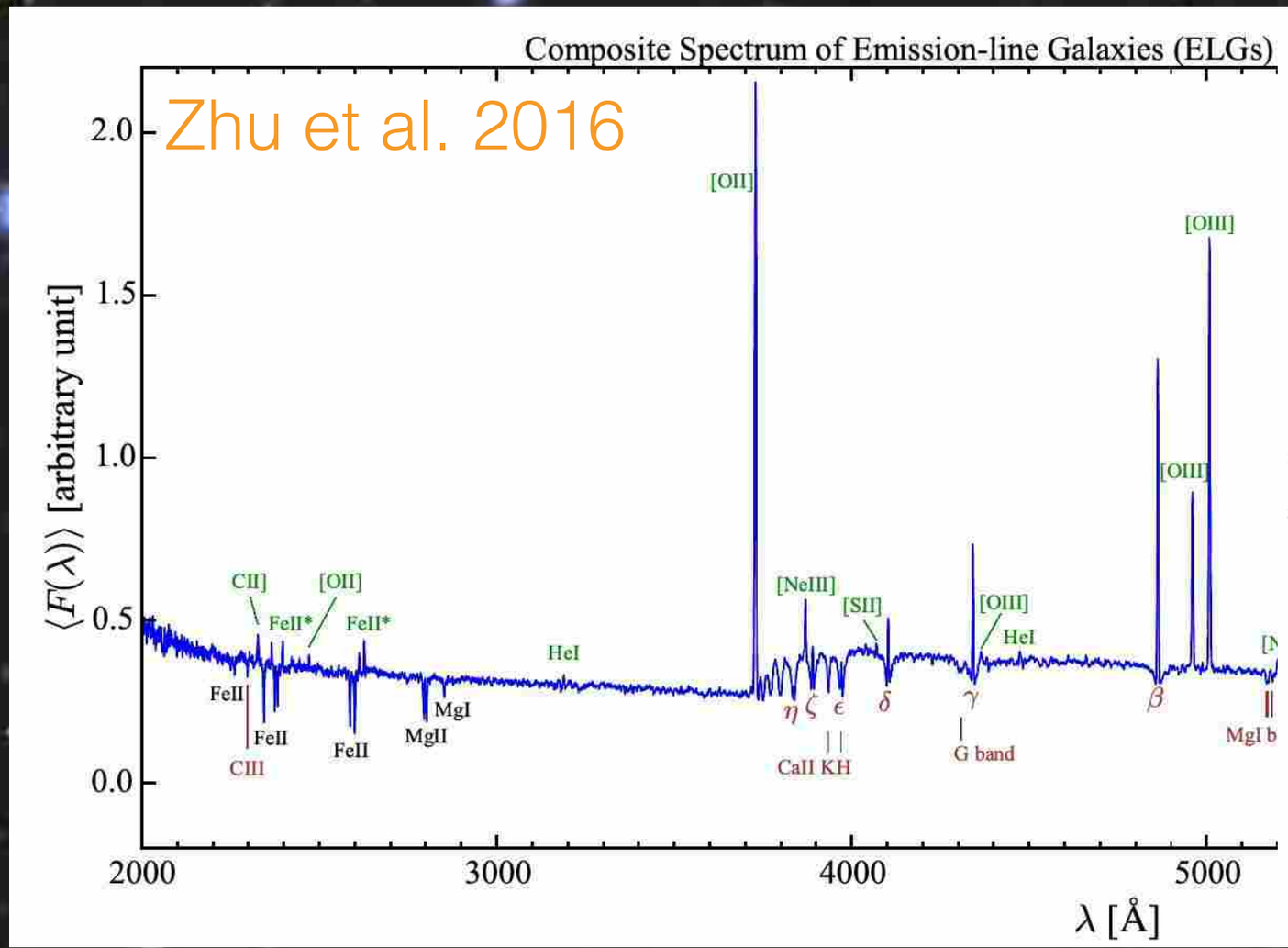
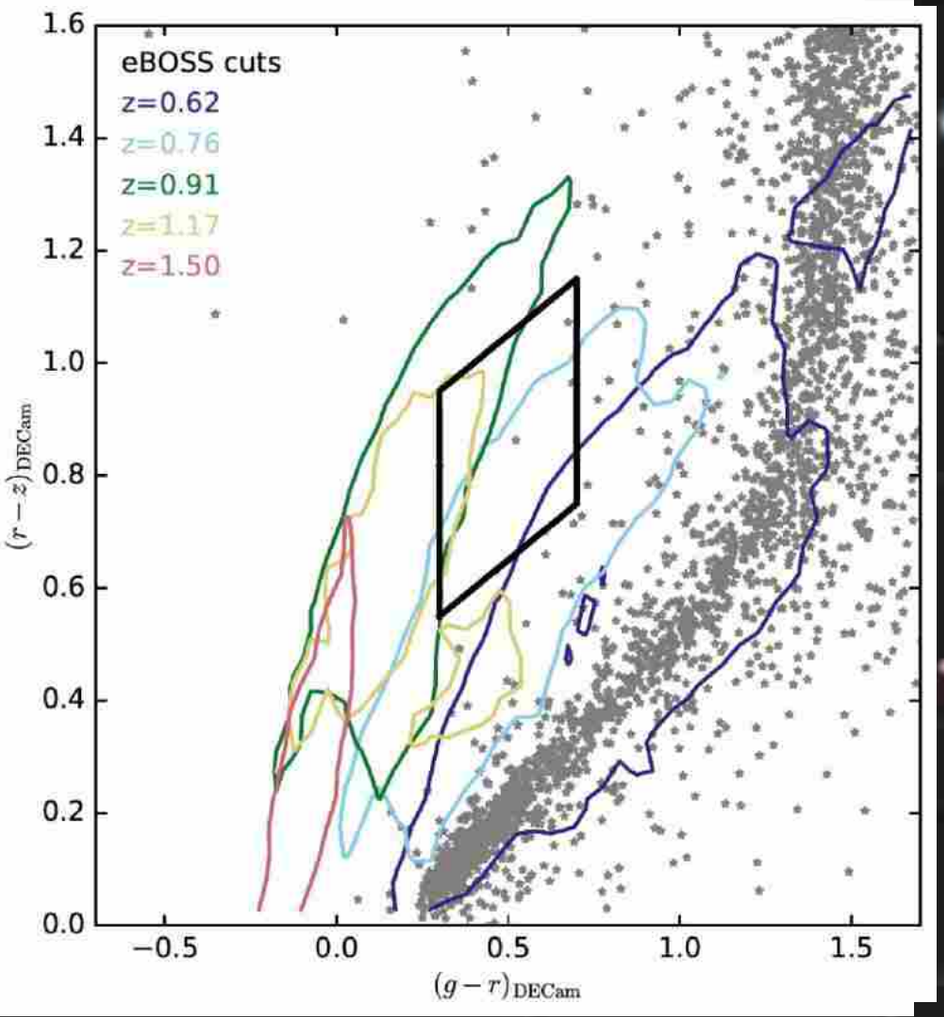
Background image: DECALS photometry and eBOSS ELGs



+ WiggleZ, 4Most, Wfirst, Hetdex,...





DECALS photometry and eBOSS ELGs

How do we model emission line galaxies?

1. Assuming SF galaxies are ELGs.
2. Relating SFR to OII.
3. Assuming one typical HII region for different metallicities.
4. Coupling results from a range of HII regions, using the results of photoionisation code.

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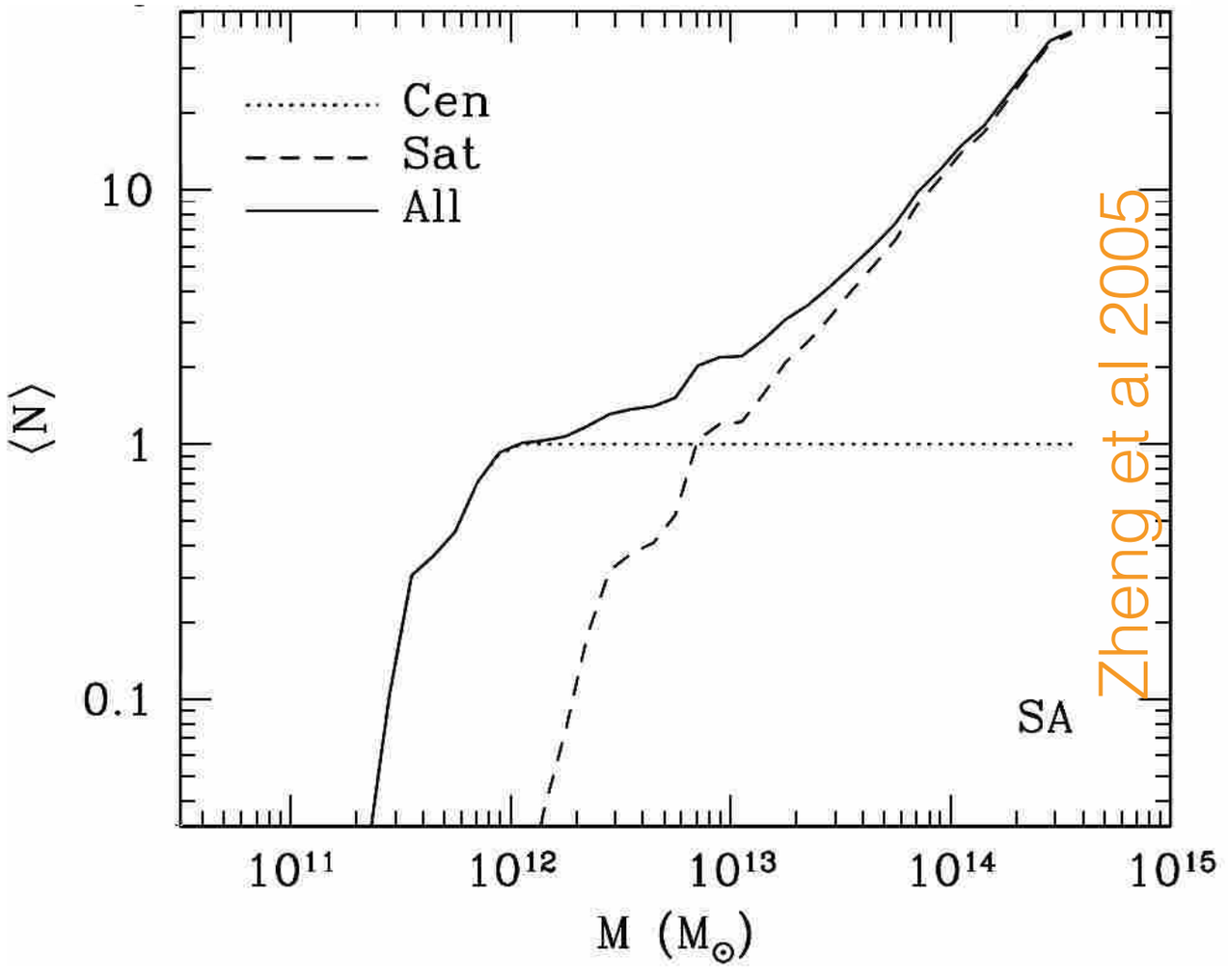
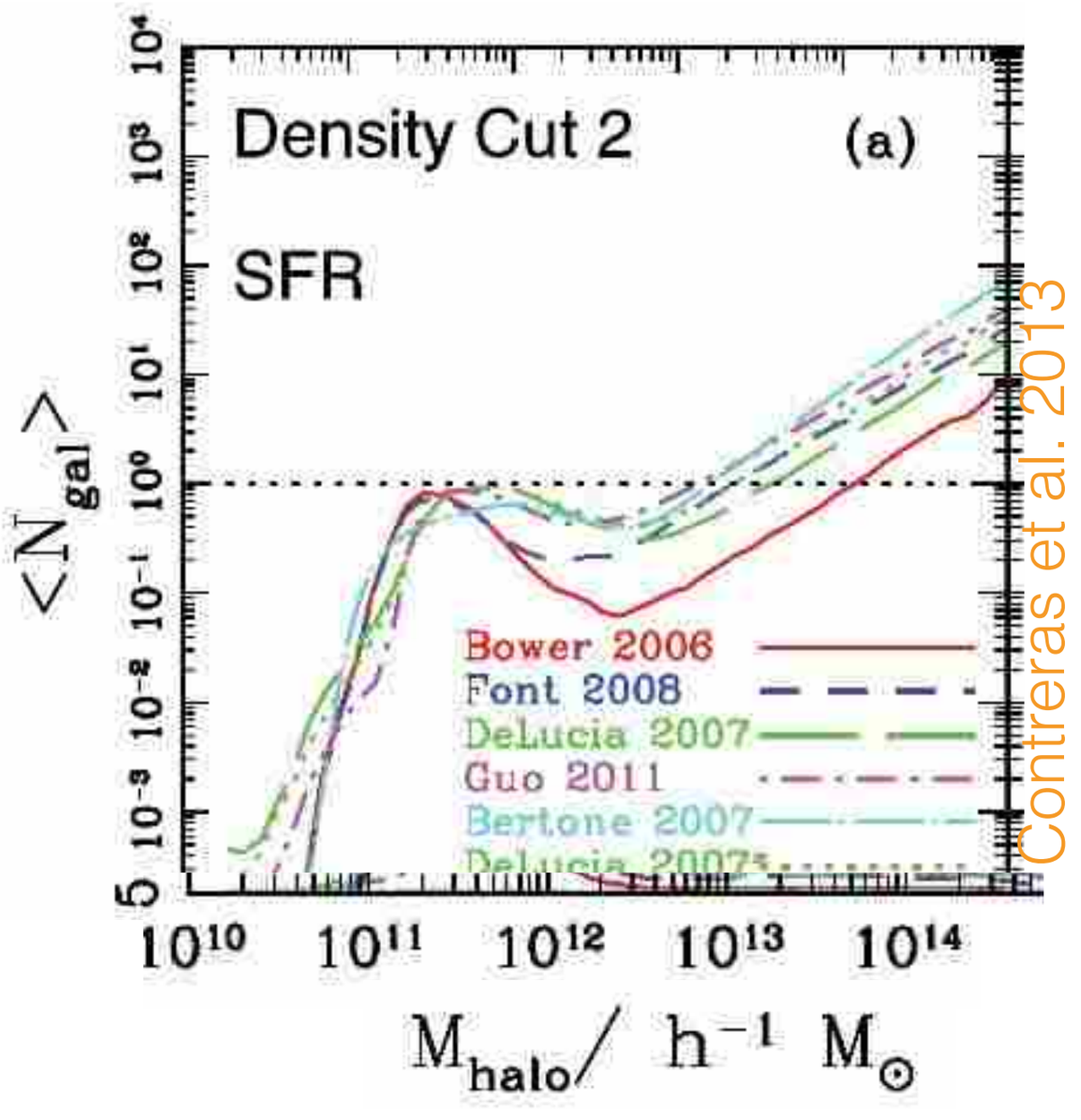
1. Assuming that ELGs are simply SF galaxies:

The HOD for a SFR-selected sample of galaxies

Mass selected sample



Zheng et al 2005



Contreras et al. 2013

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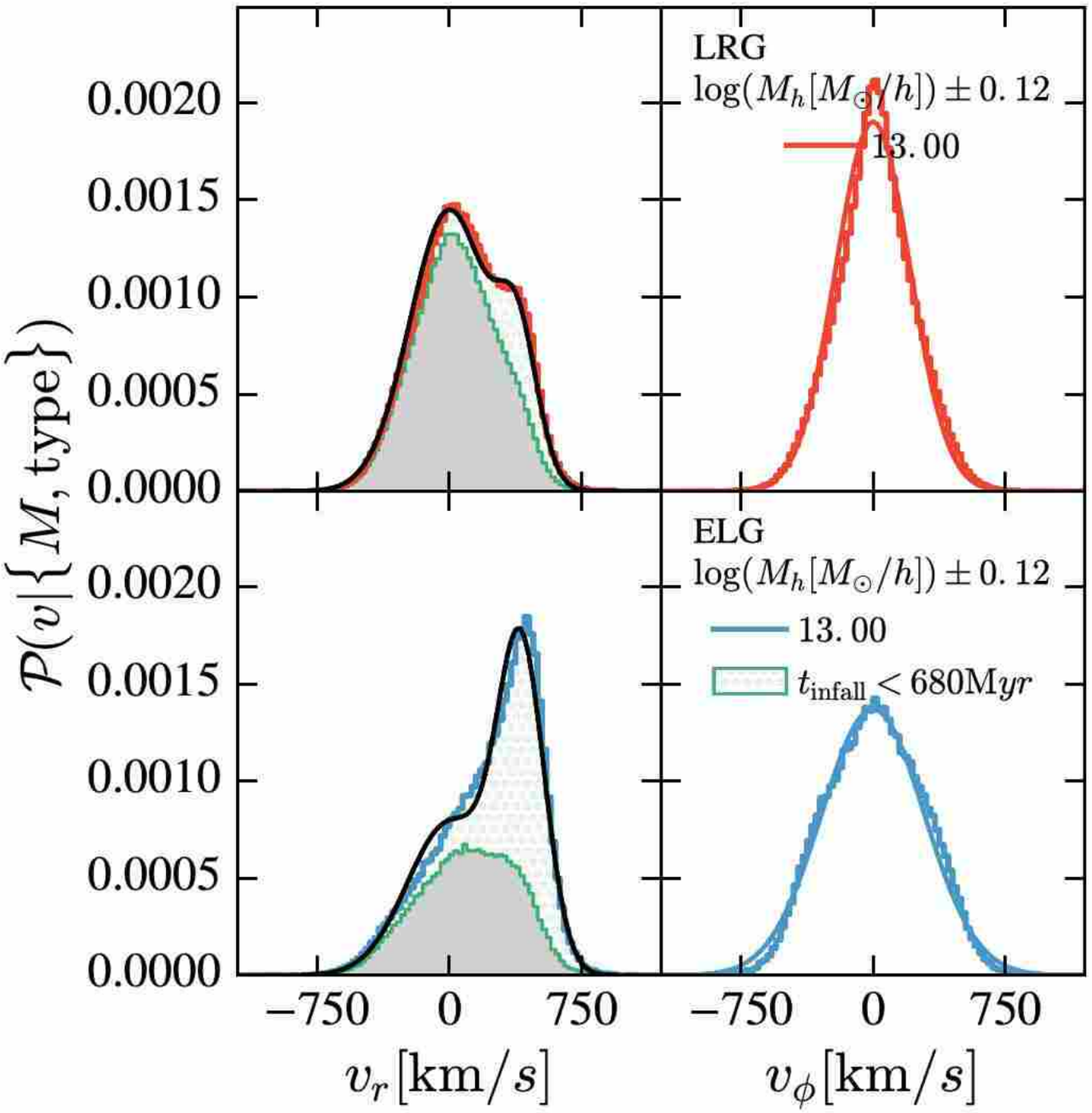

Orsi and Angulo 2018

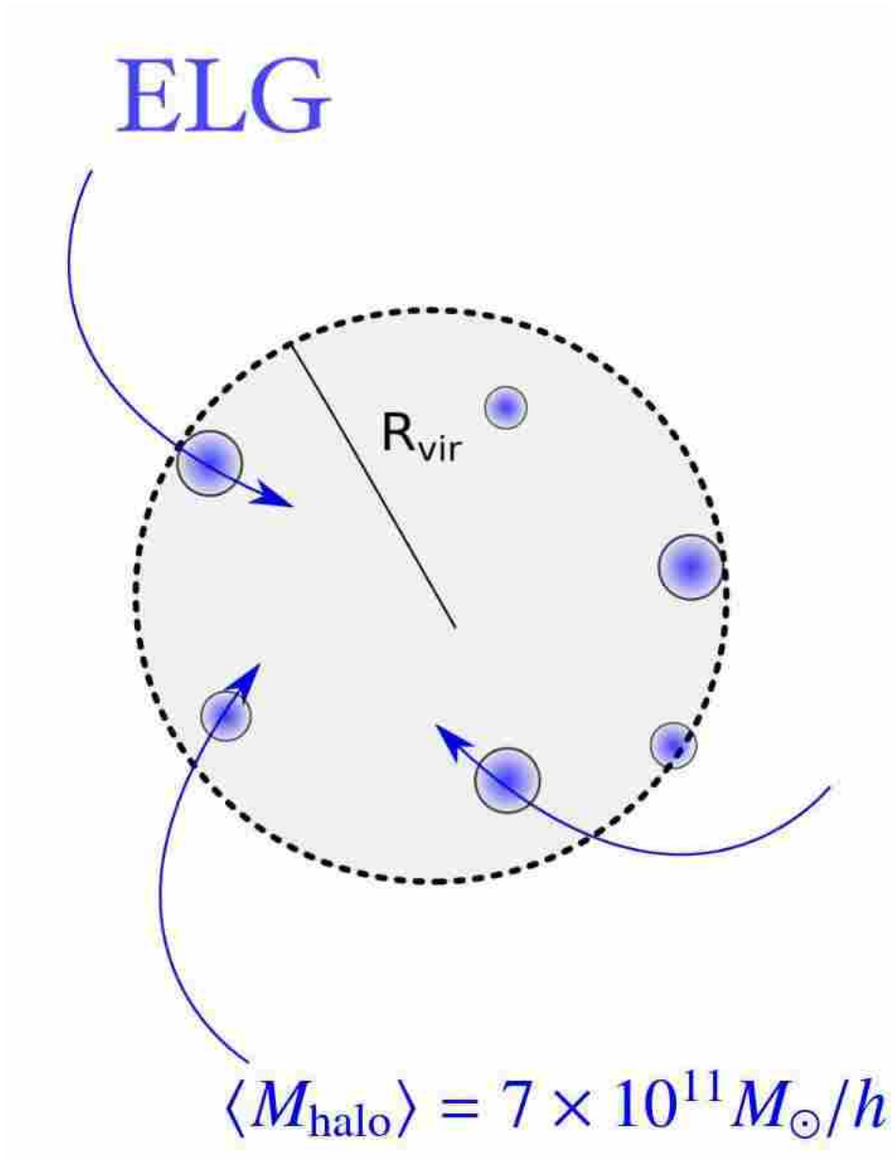

Figure 8. The intra-halo velocity distribution components along the radial ($v_{\rm inf}$, left) and the tangential (v_ϕ, right) components. The black solid lines show the resulting best fit from Model C. The green dotted region corresponds to galaxies accreted within the last 680Myr.

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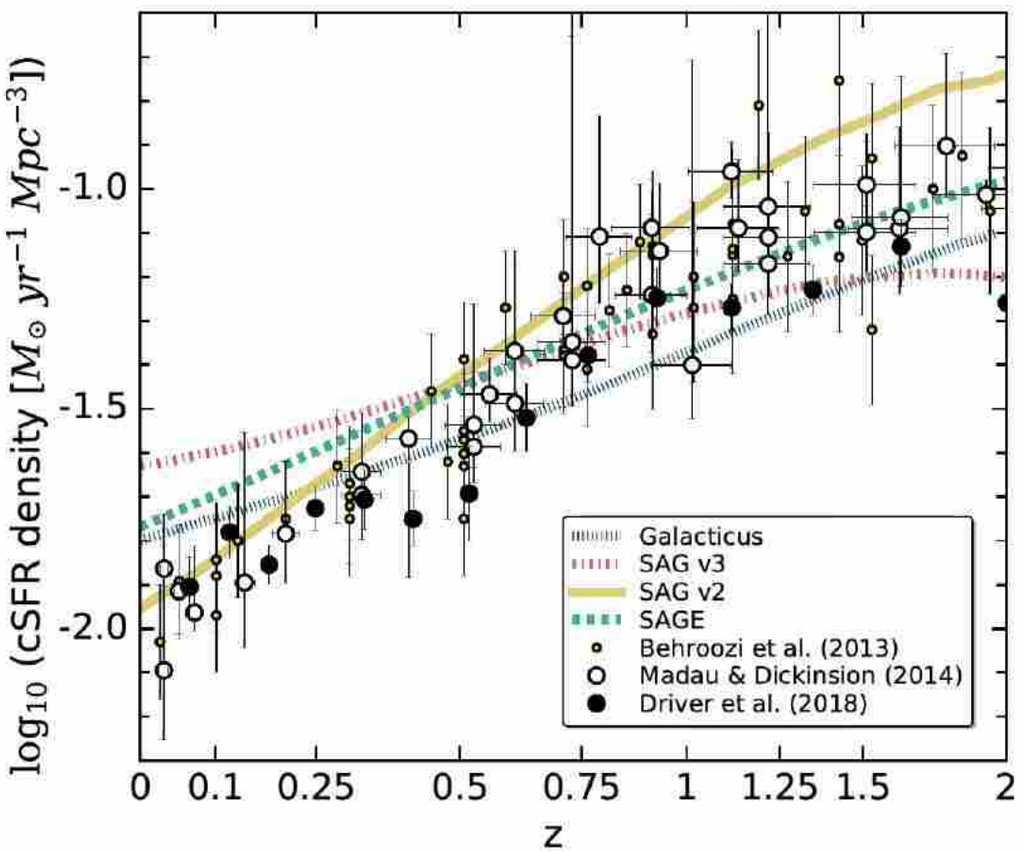
4. Coupling with photoionisation models

Results from work done in collaboration with Ginevra Favole

https://github.com/aaorsi/get_emlines

The MULTIDARK galaxies



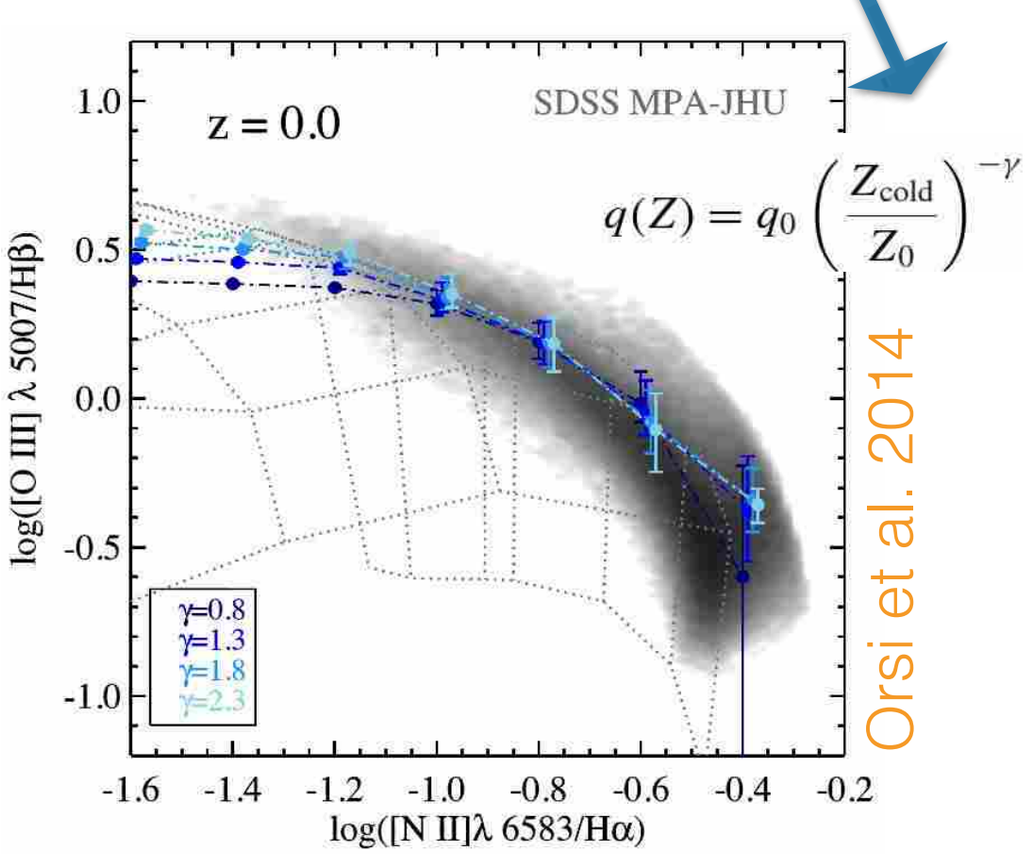
Plot by Doris Stoppacher

+

MAPPINGS

$$L(\lambda_j) = 1.37 \times 10^{-12} Q_{H^0} \frac{F(\lambda_j, q, Z_{cold})}{F(H\alpha, q, Z_{cold})}$$

$$Q_{H^0} = \log_{10} 1.35 + \log_{10} SFR + 53.0.$$



Orsi et al. 2014

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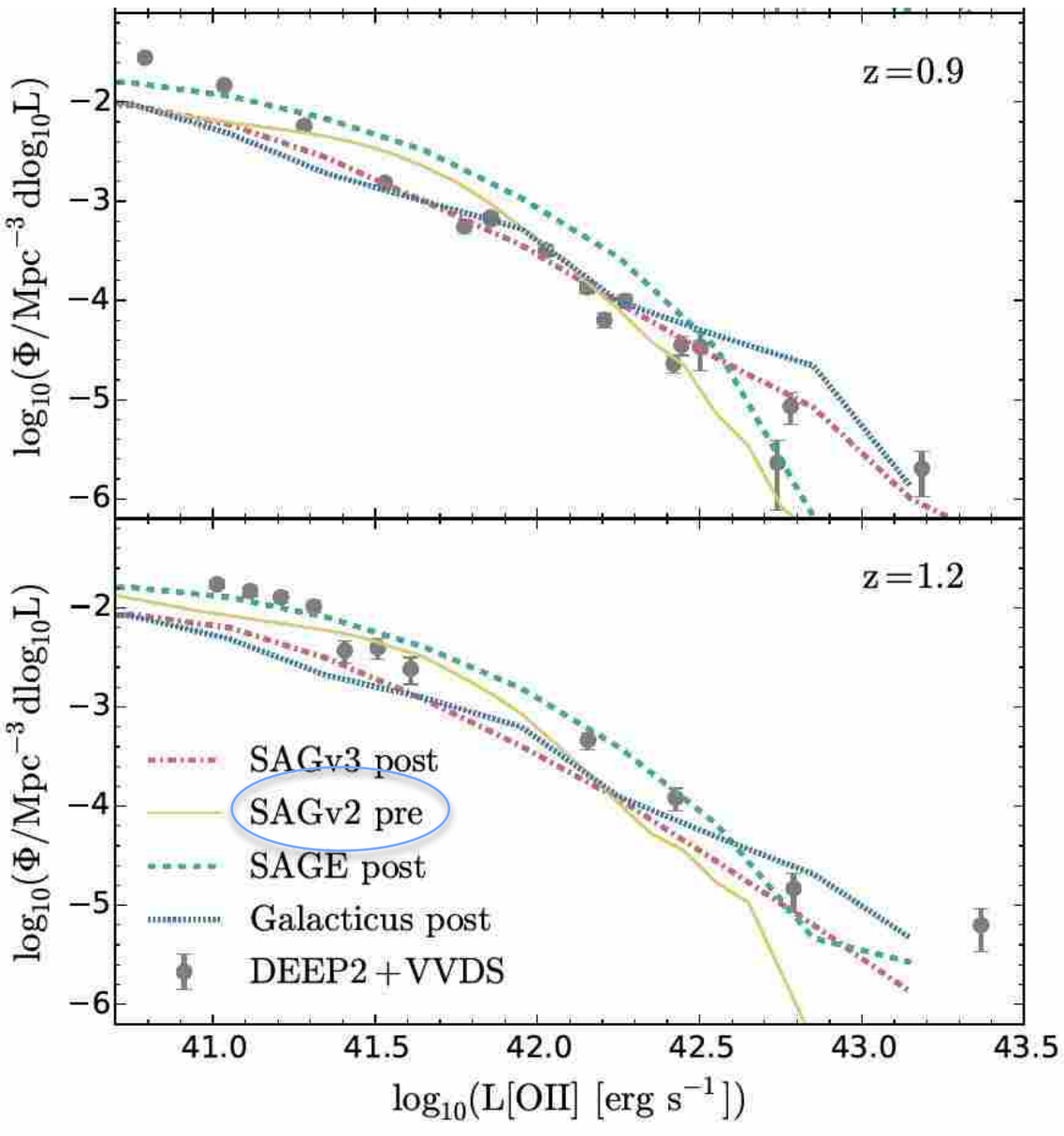

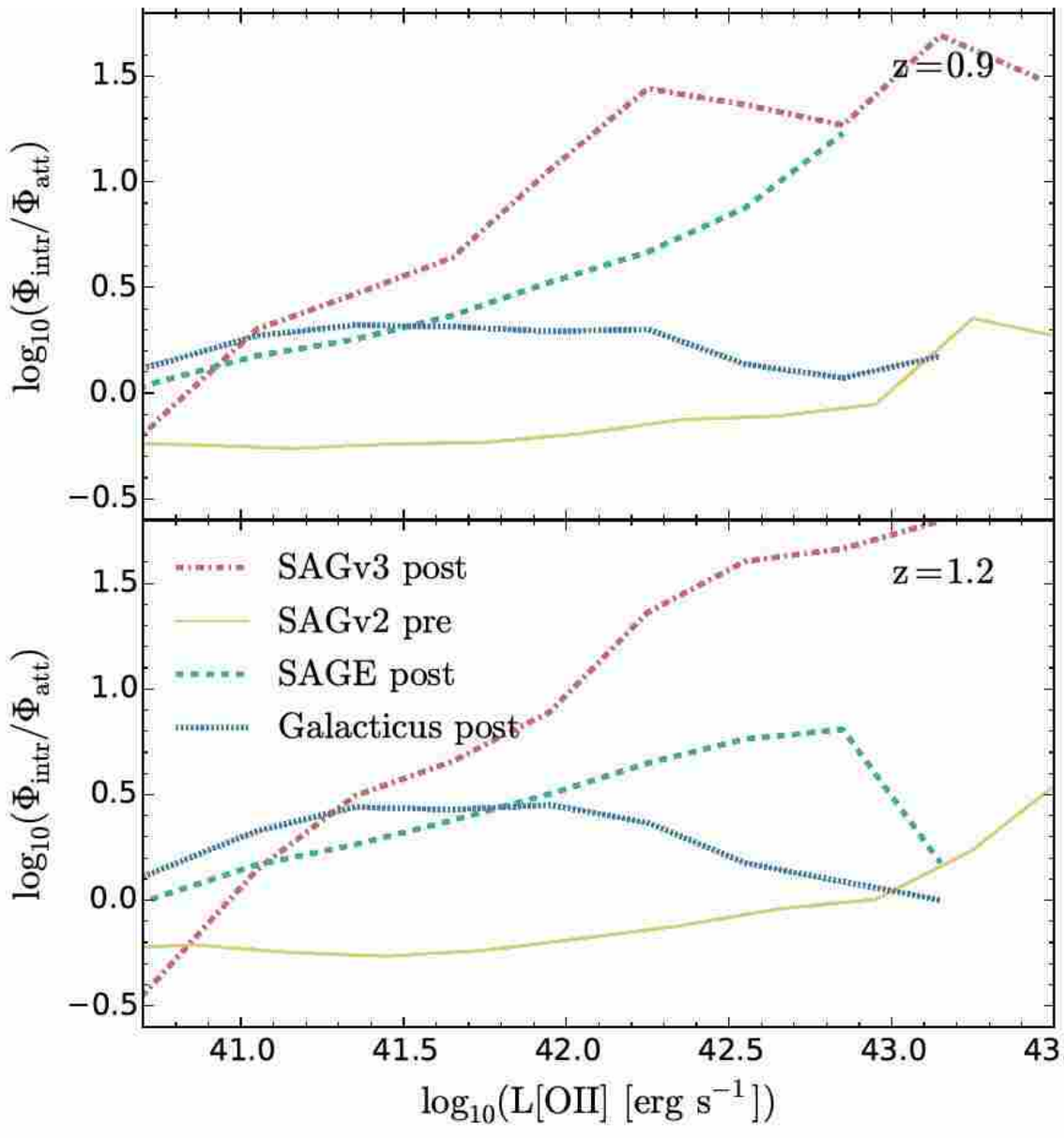

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2. Relating the SFR to emission line luminosities:

Results from work done in collaboration with Ginevra Favole.

the Moustakas et al. (2006) relation (see also Comparat et al. 2015) calibrated at $z = 0.1$,

$$\mathrm{L}^{\mathrm{Moust}}_{[\mathrm{OII}]}(\mathrm{erg\ s^{-1}}) = \frac{\mathrm{SFR}_{[\mathrm{OII}]}(\mathrm{M_\odot\ yr^{-1}})}{2.18 \times 10^{-41}}, \qquad (15)$$

the Sobral et al. (2012) formulation optimized at $z = 1.47$,

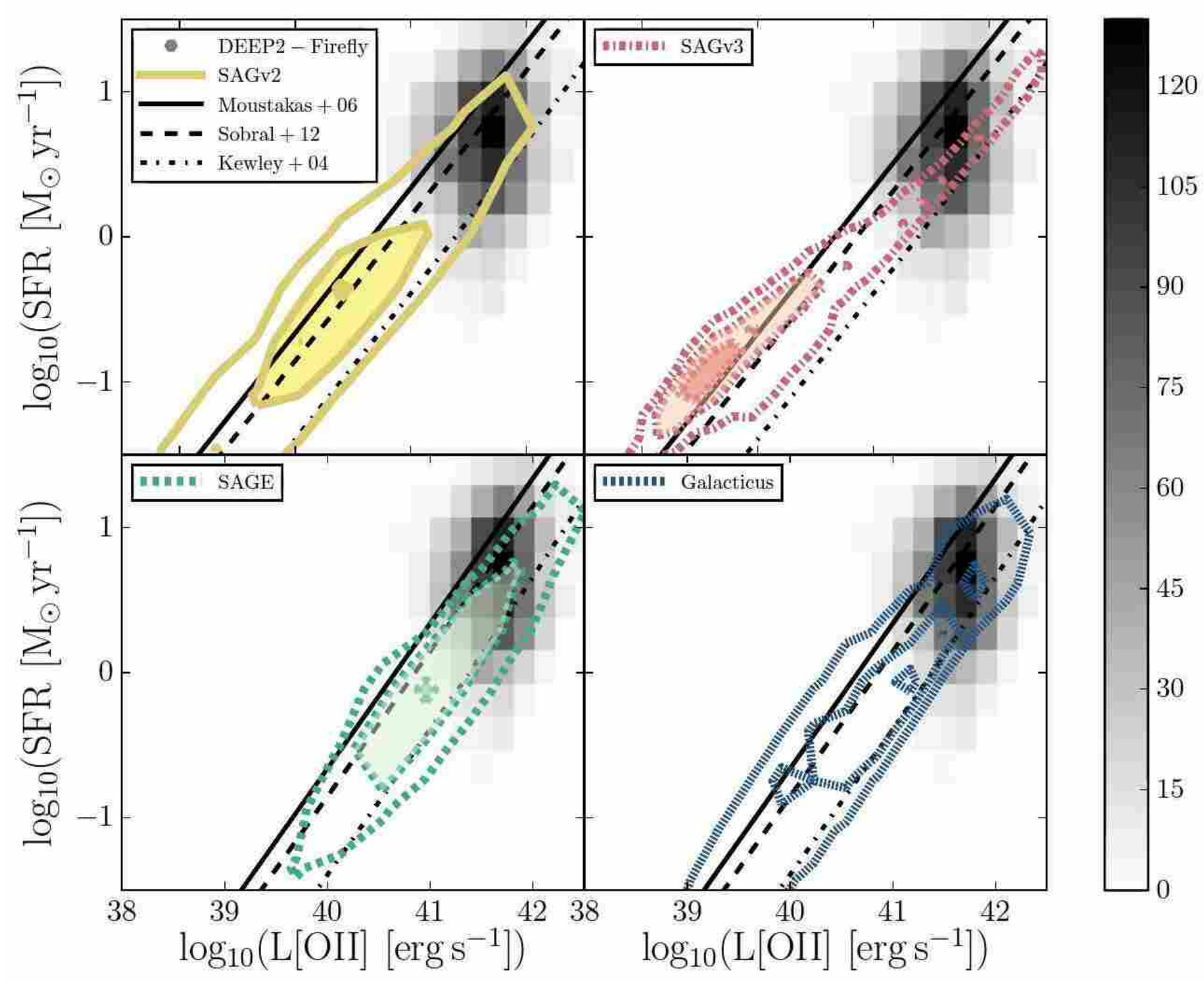
$$\mathrm{L}^{\mathrm{Sob}}_{[\mathrm{OII}]}(\mathrm{erg\ s^{-1}}) = \frac{\mathrm{SFR}_{[\mathrm{OII}]}(\mathrm{M_\odot\ yr^{-1}})}{1.4 \times 10^{-41}}, \qquad (16)$$

the Kewley et al. (2004) conversion calibrated at $z = 1$,

$$\mathrm{L}^{\mathrm{Kew}}_{[\mathrm{OII}]}(\mathrm{erg\,s^{-1}}) = \frac{\mathrm{SFR}_{[\mathrm{OII}]}(\mathrm{M_\odot\ yr^{-1}})}{7.9 \times 10^{-42}} \times (a[12 + \log_{10}(\mathrm{O/H})_{\mathrm{gal}}] + b). \qquad (17)$$

+ the relation between the rest-frame UV magnitudes and the nebular emission.

2. Relating the SFR to emission line luminosities:



https://github.com/FireflySpectra/firefly_release

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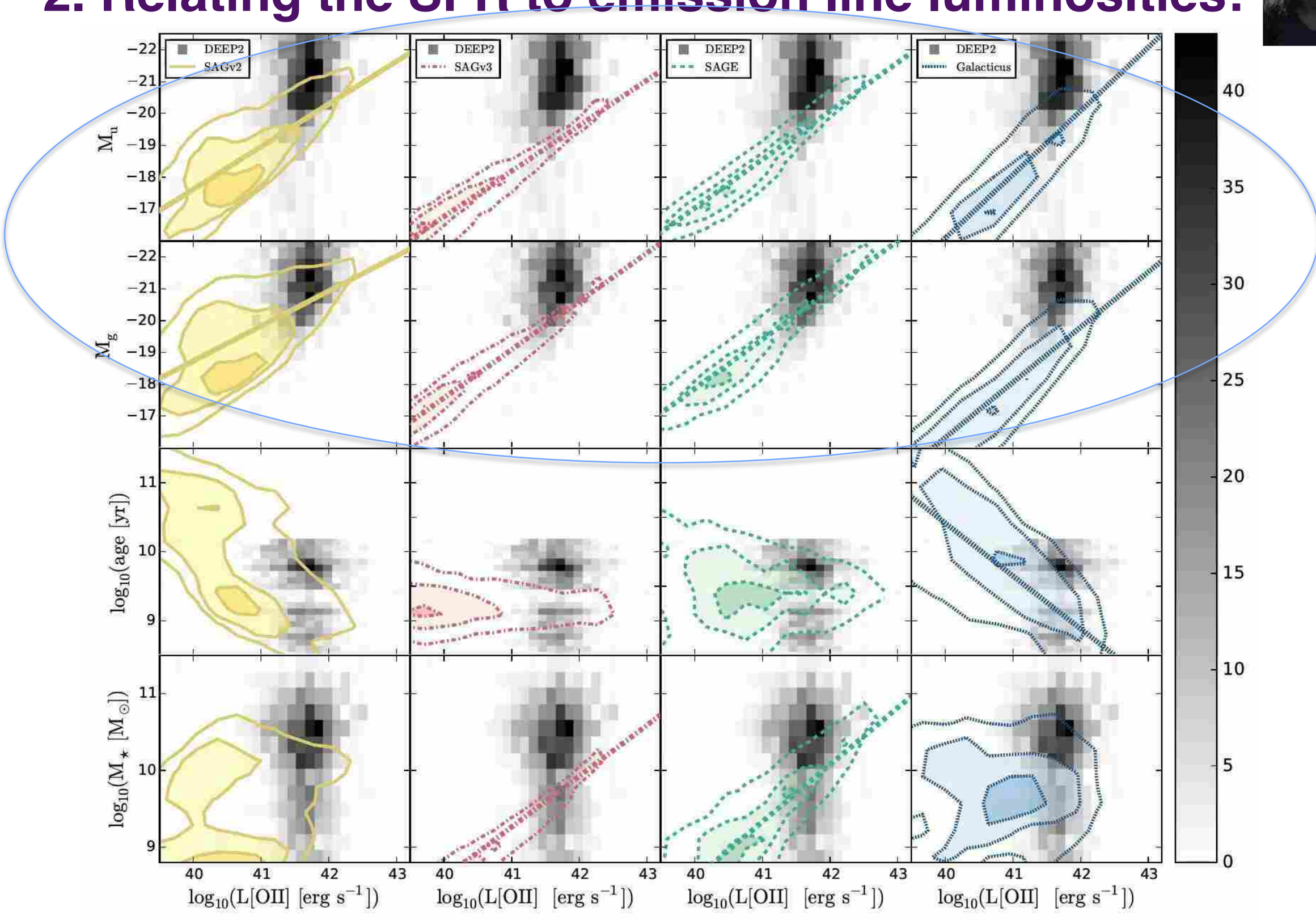

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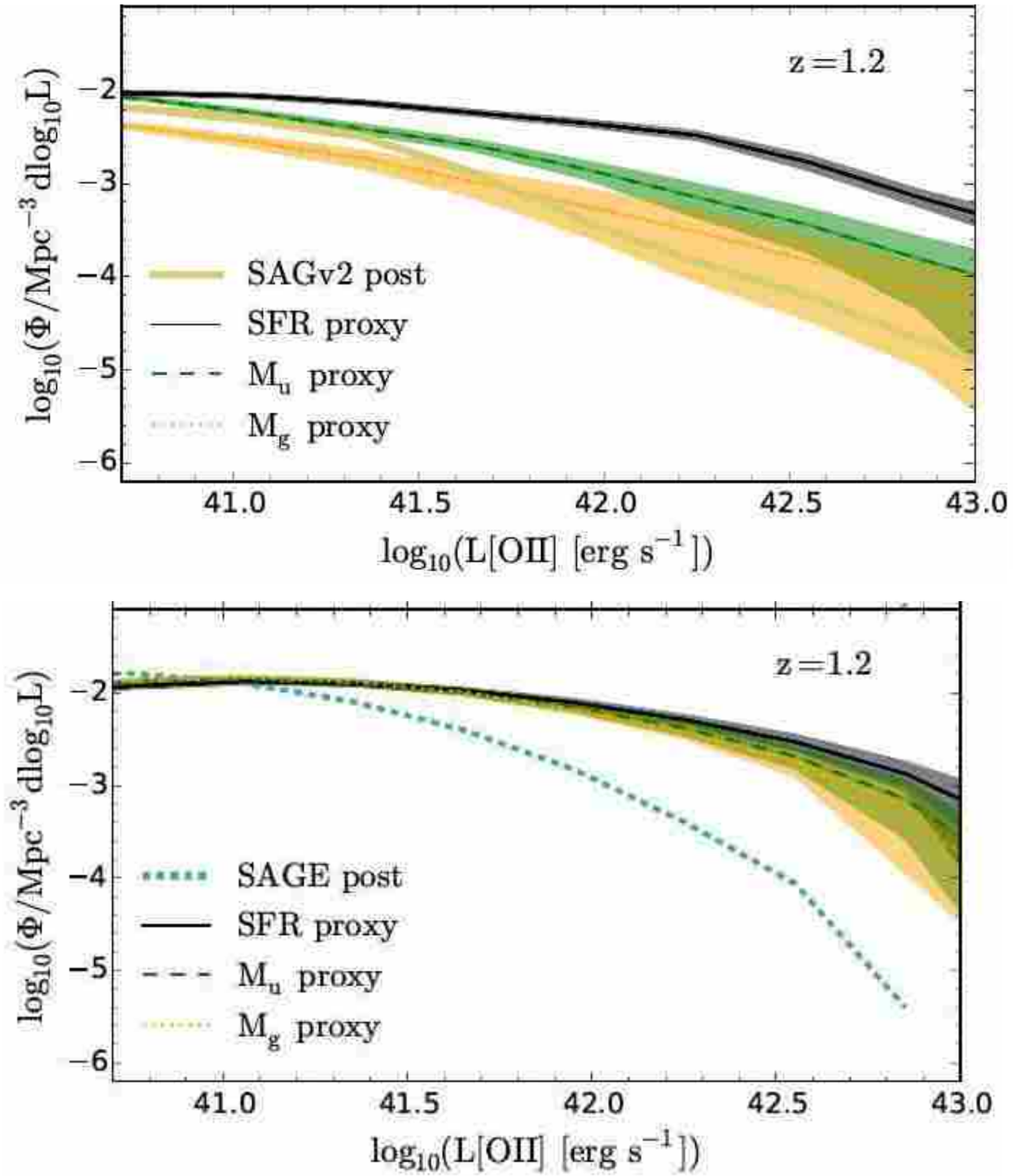

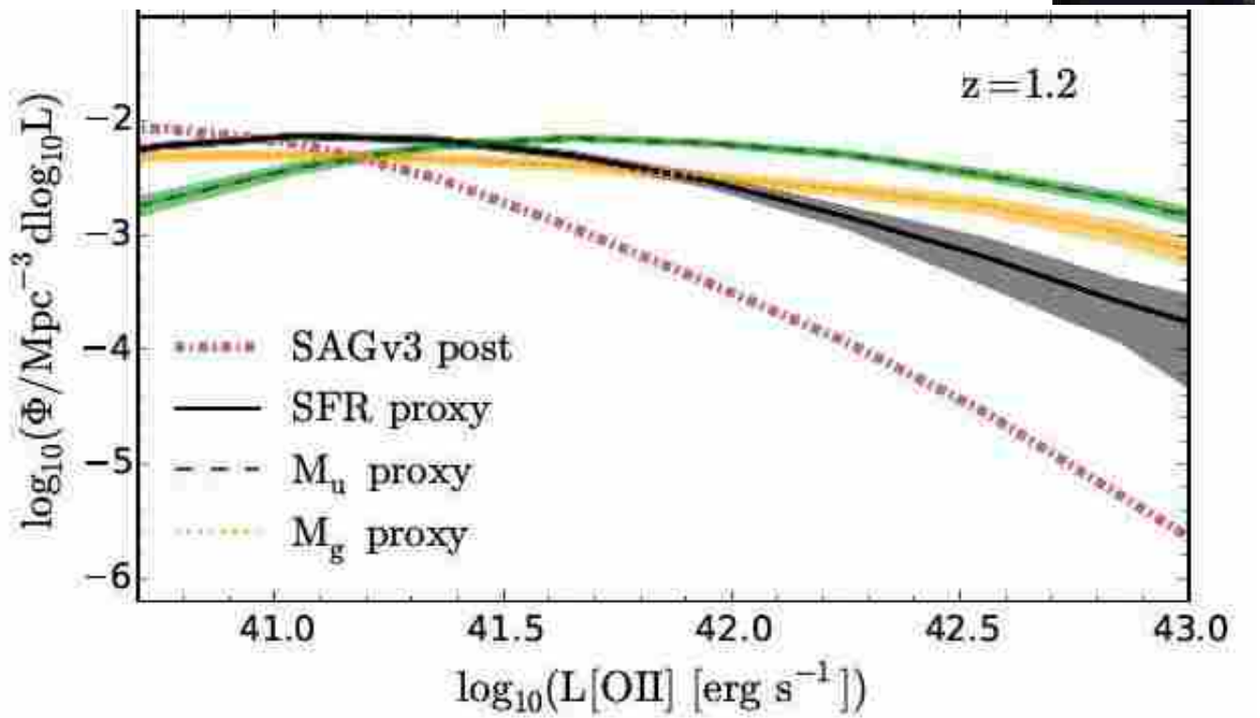

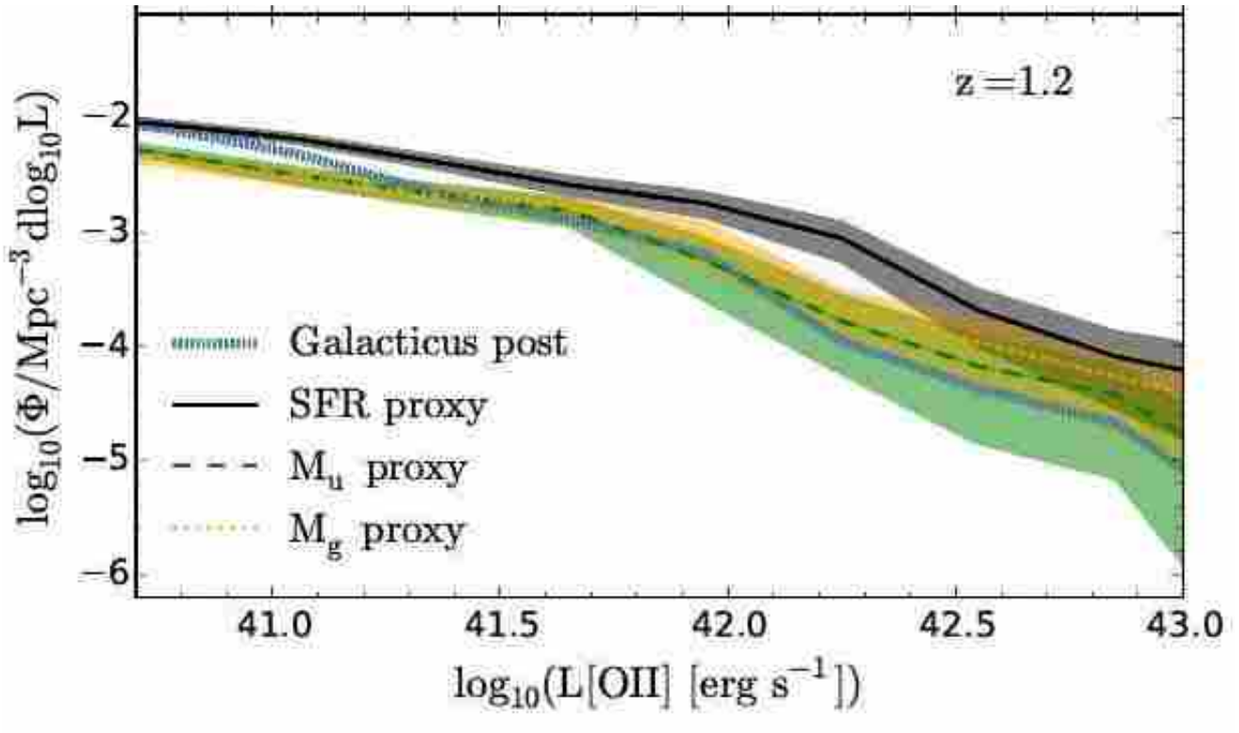

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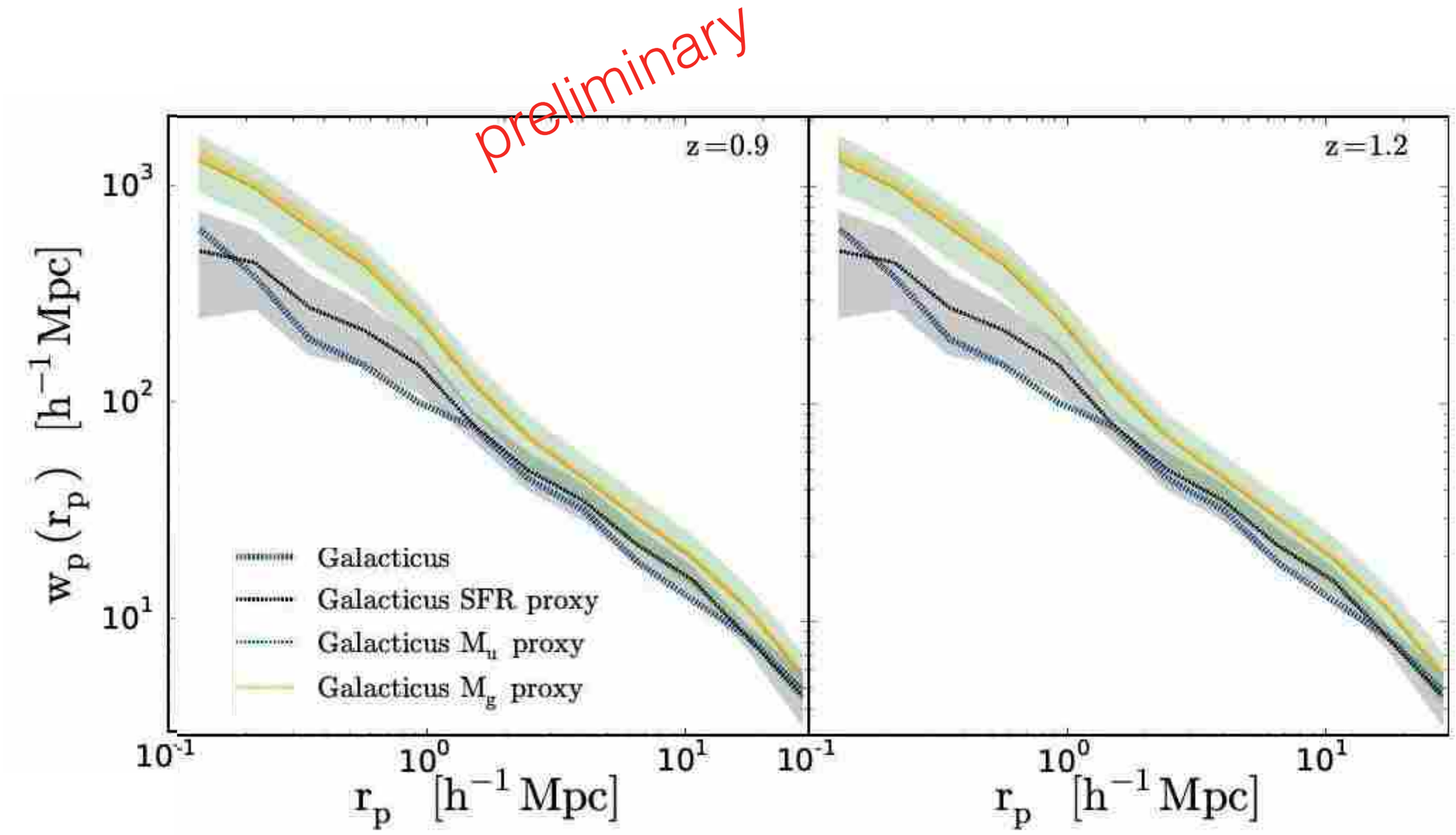

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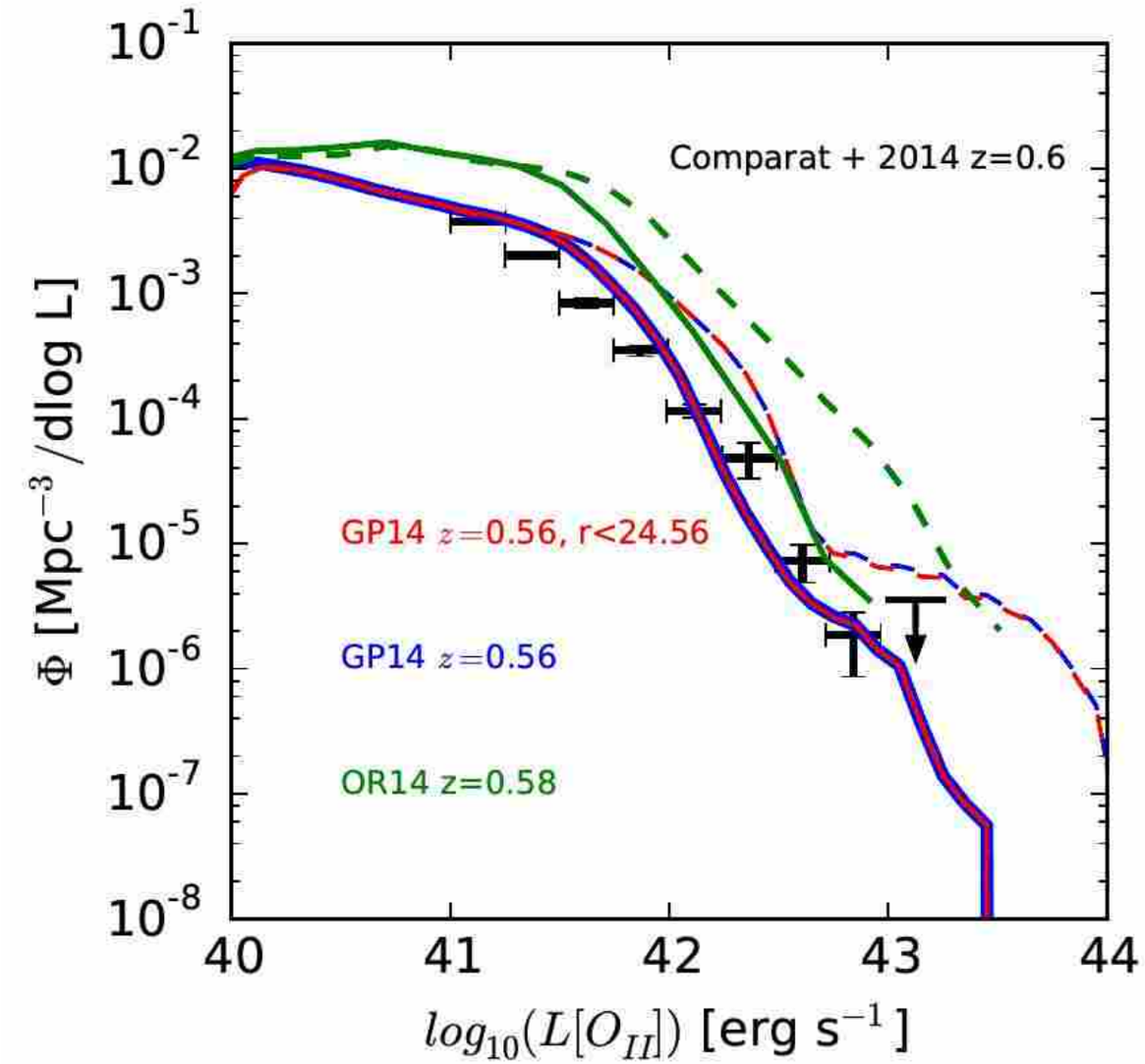
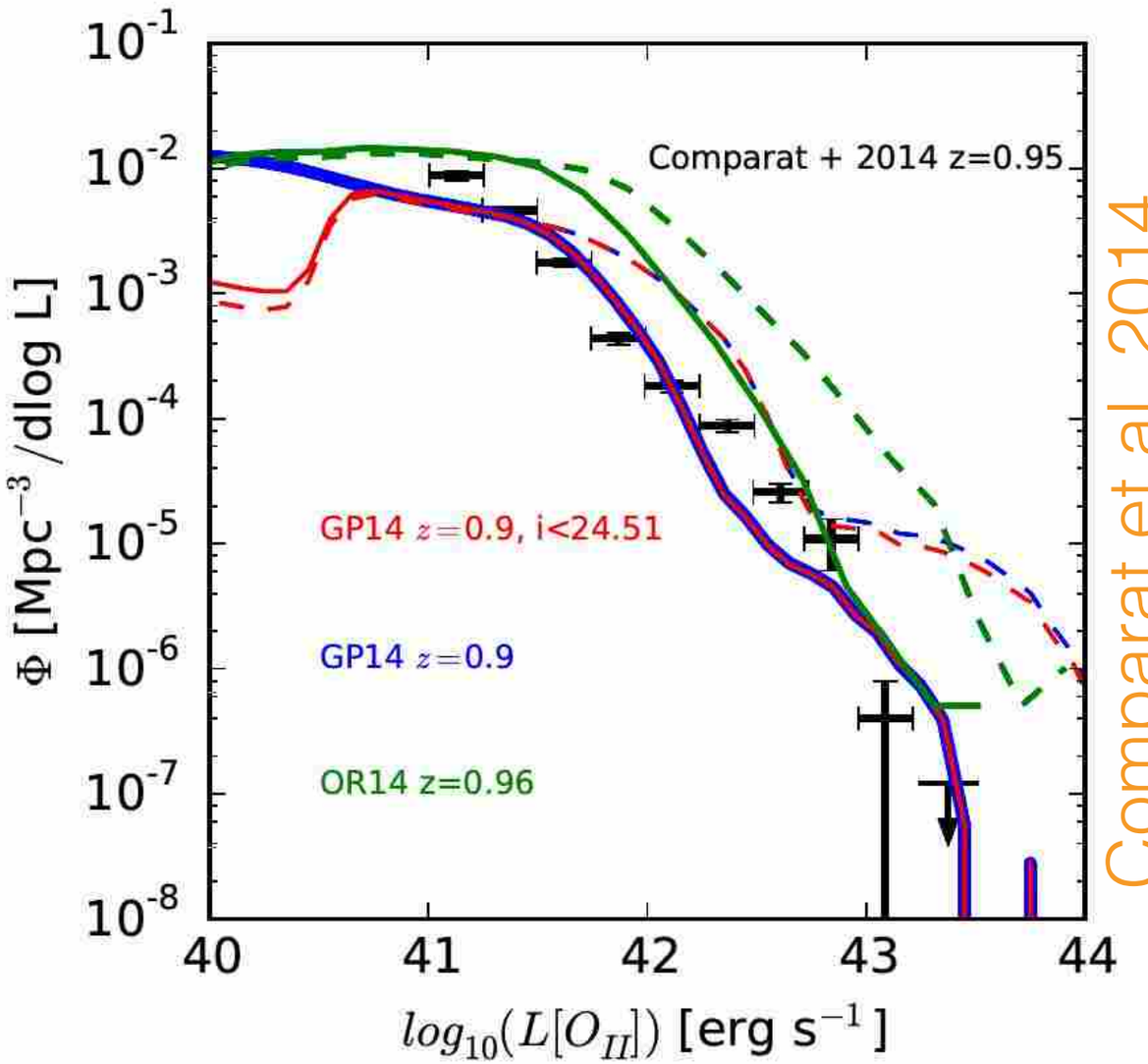
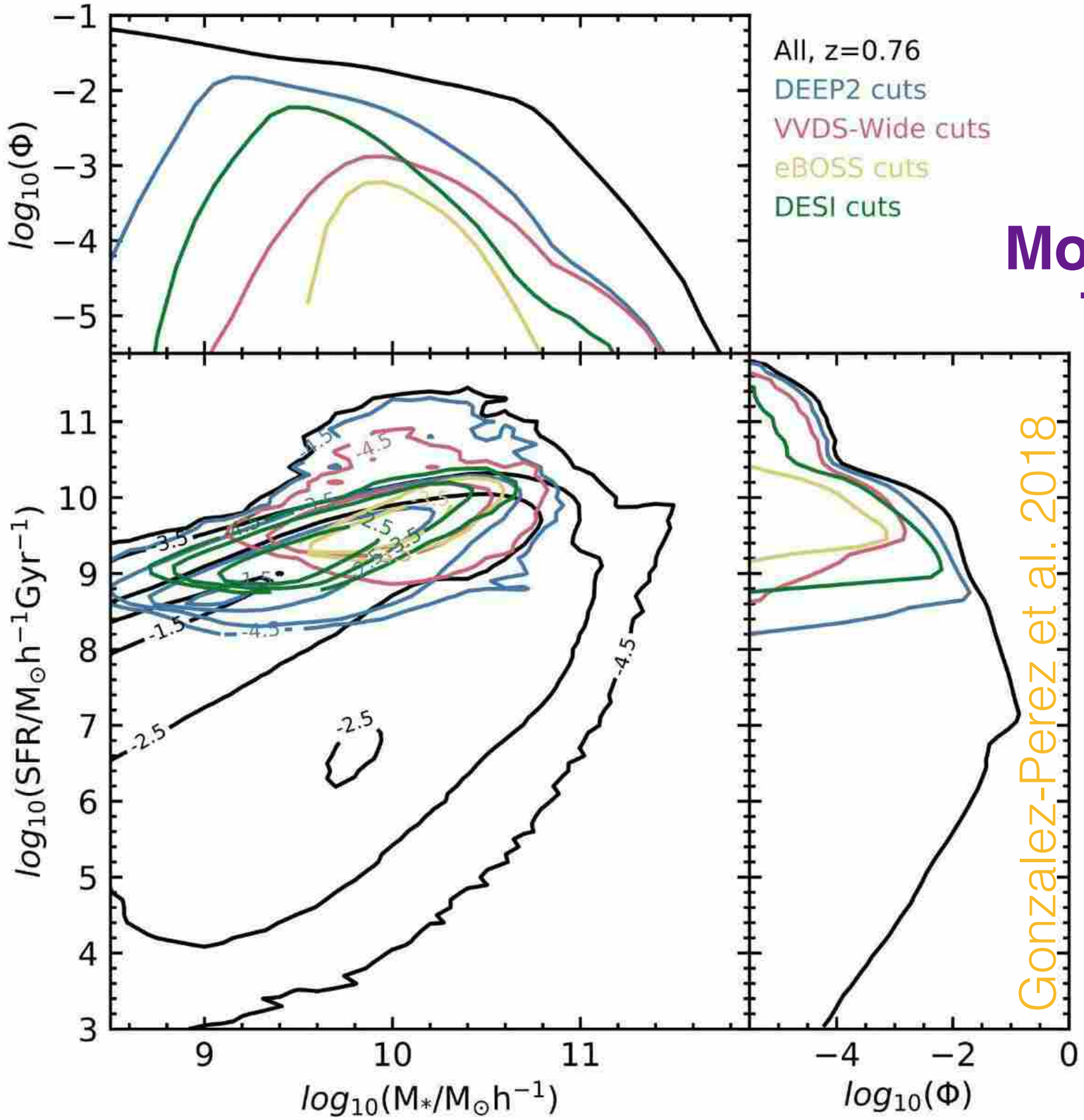
3. Average HII region and
4. Coupling with photoionisation models





3. A typical HII region with different metallicities:



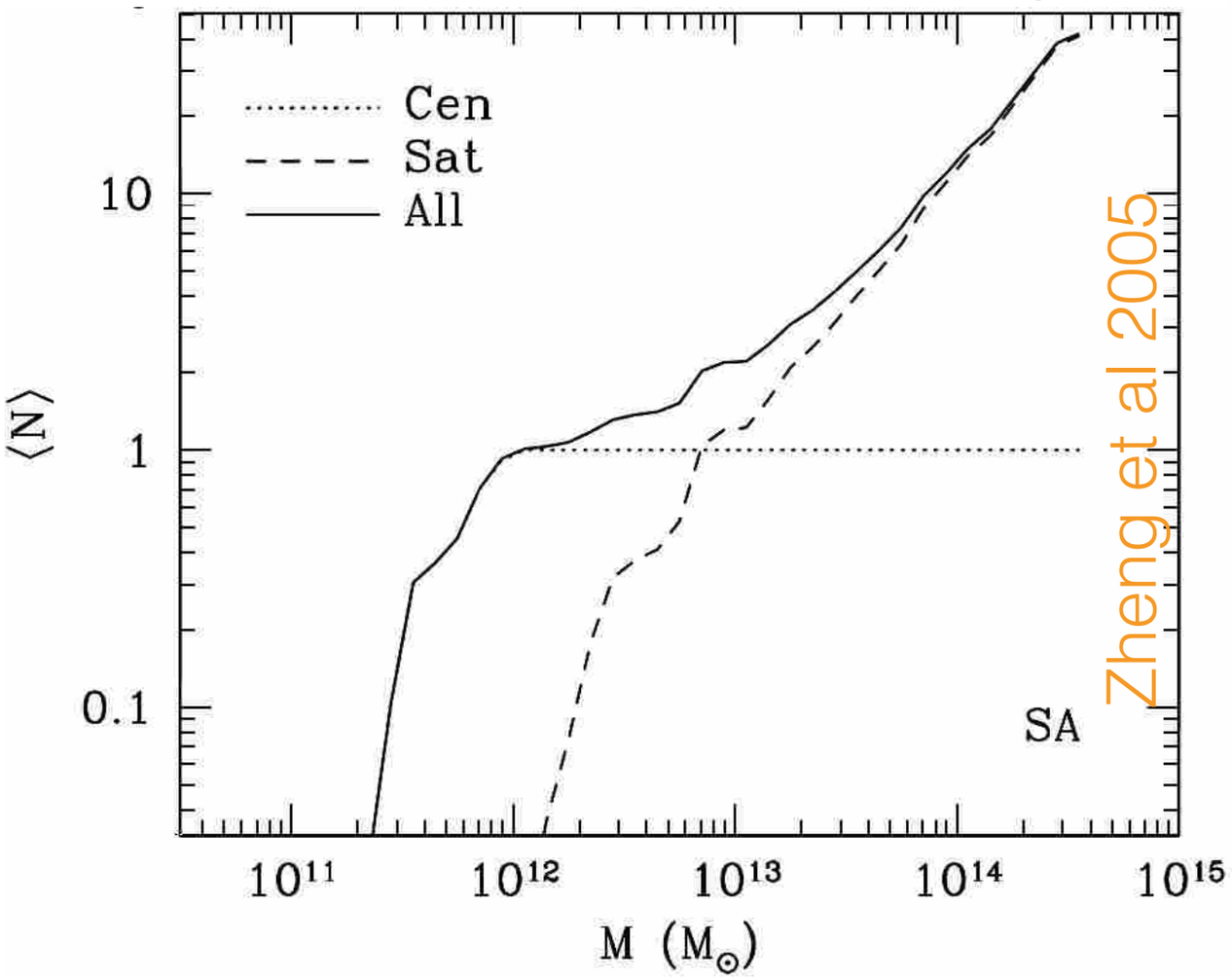
Model [OII] emitters from the SAM GALFORM

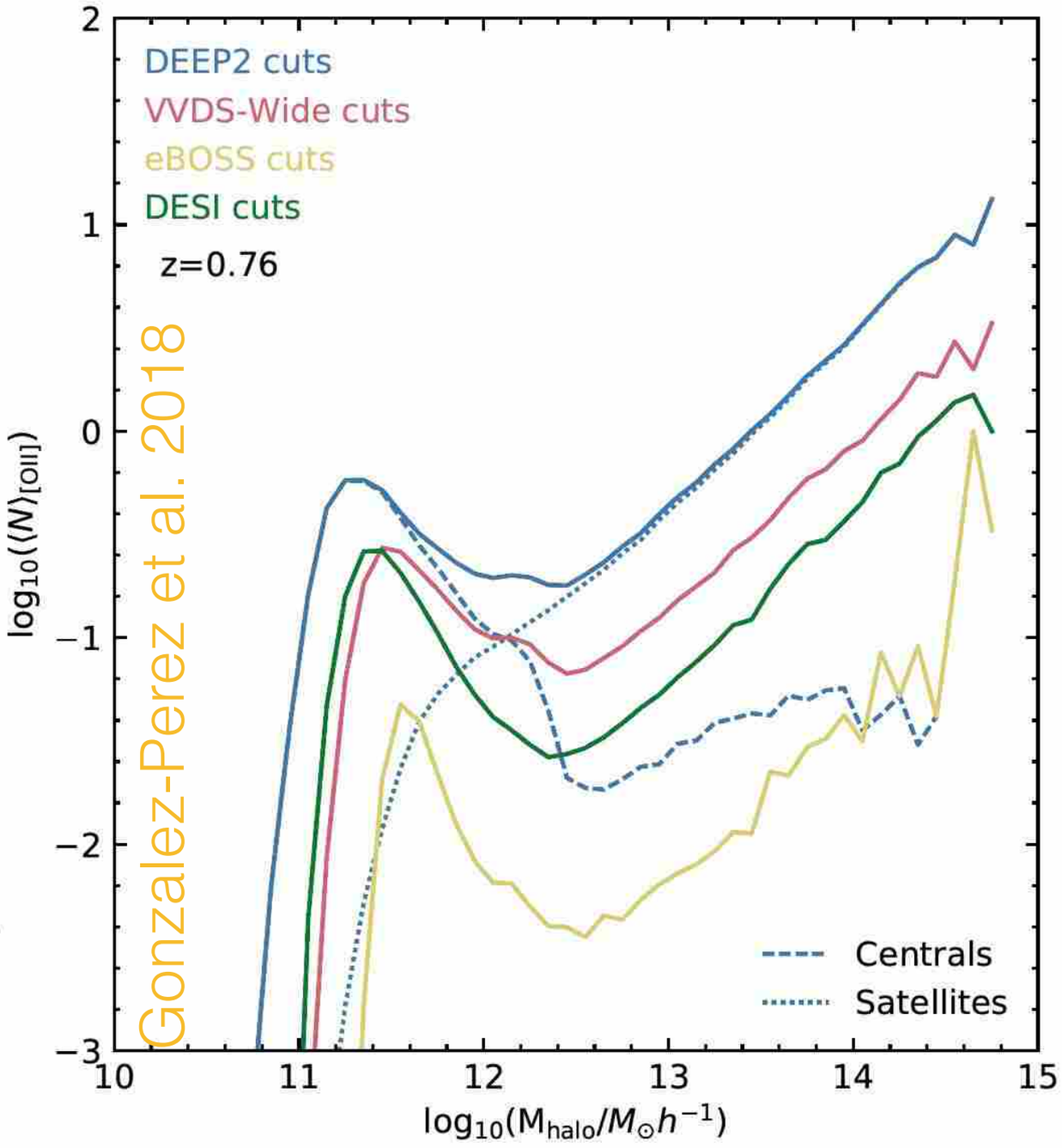
- They are SF
- 90% are centrals.
- They live in haloes with $M>10^{10.3}$ M_{Sun}/h and mean masses $M\sim10^{11.5}$ M_{Sun}/h.

3. A typical HII region with different metallicities:

Using the semi-analytical model GALFORM.

Mass selected sample





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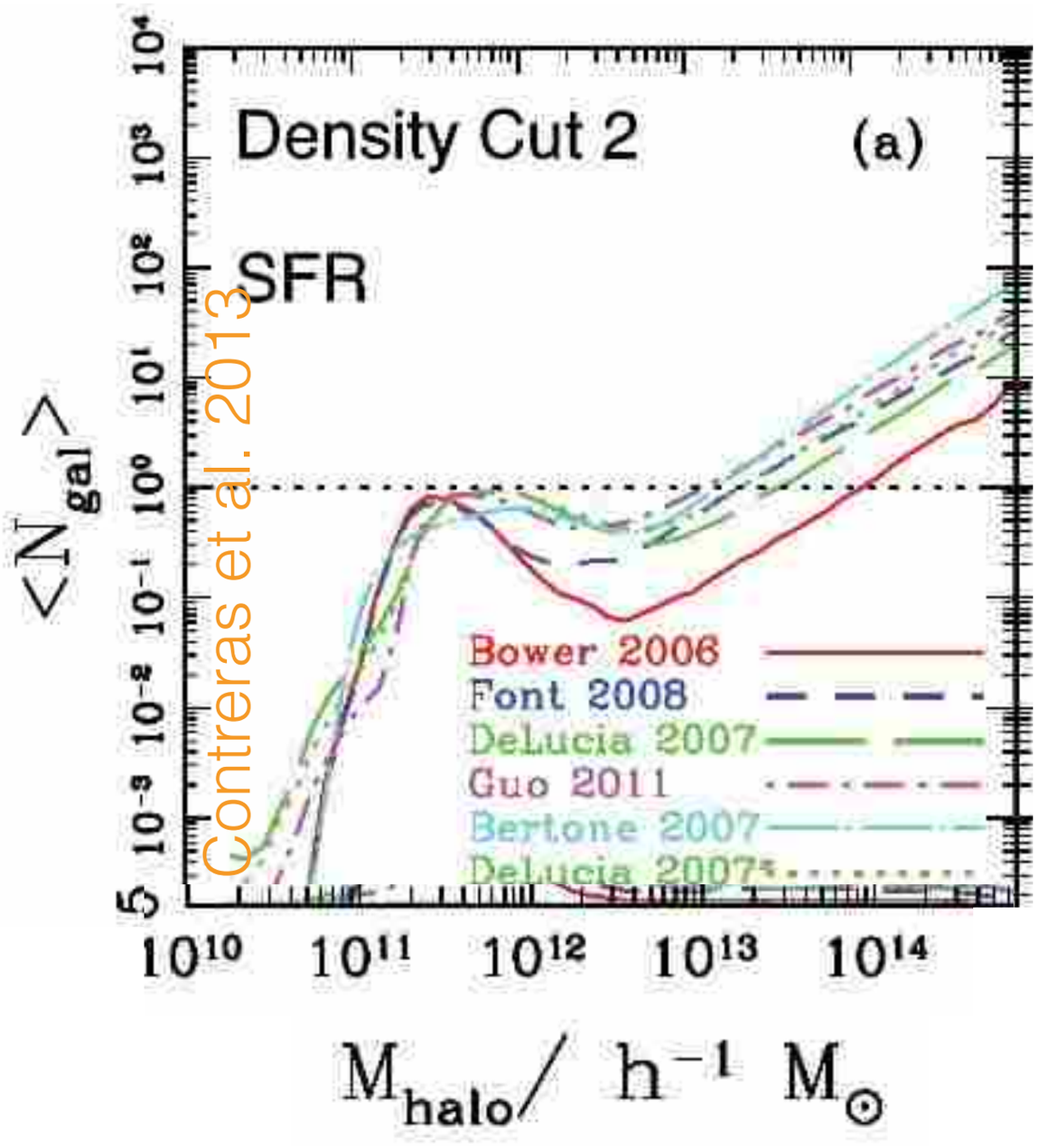

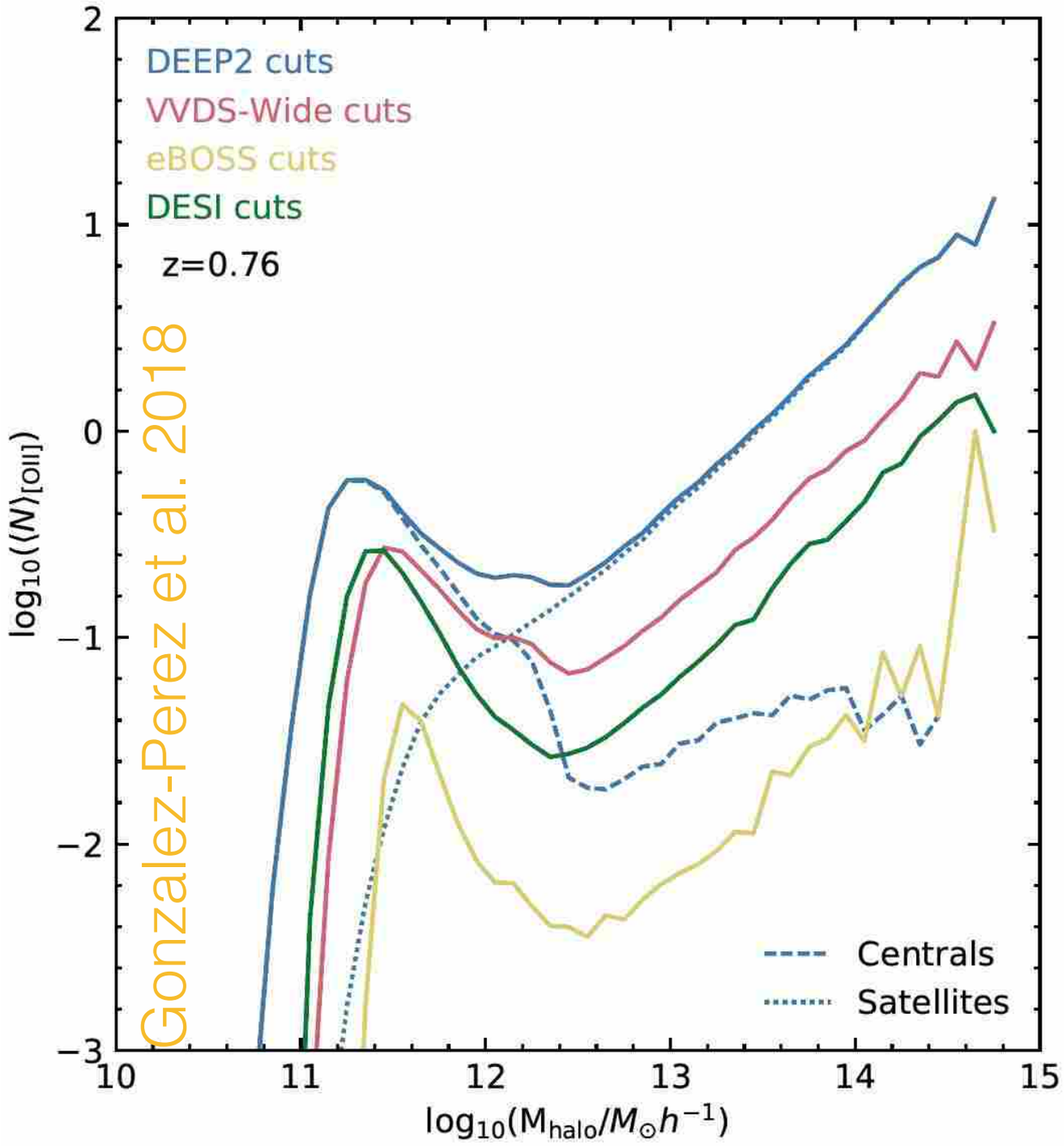

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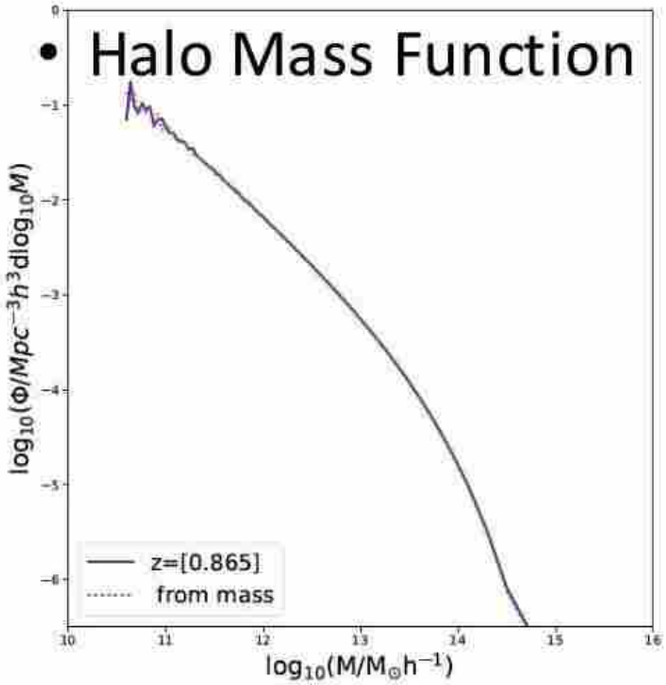
3. A typical HII region with different metallicities:

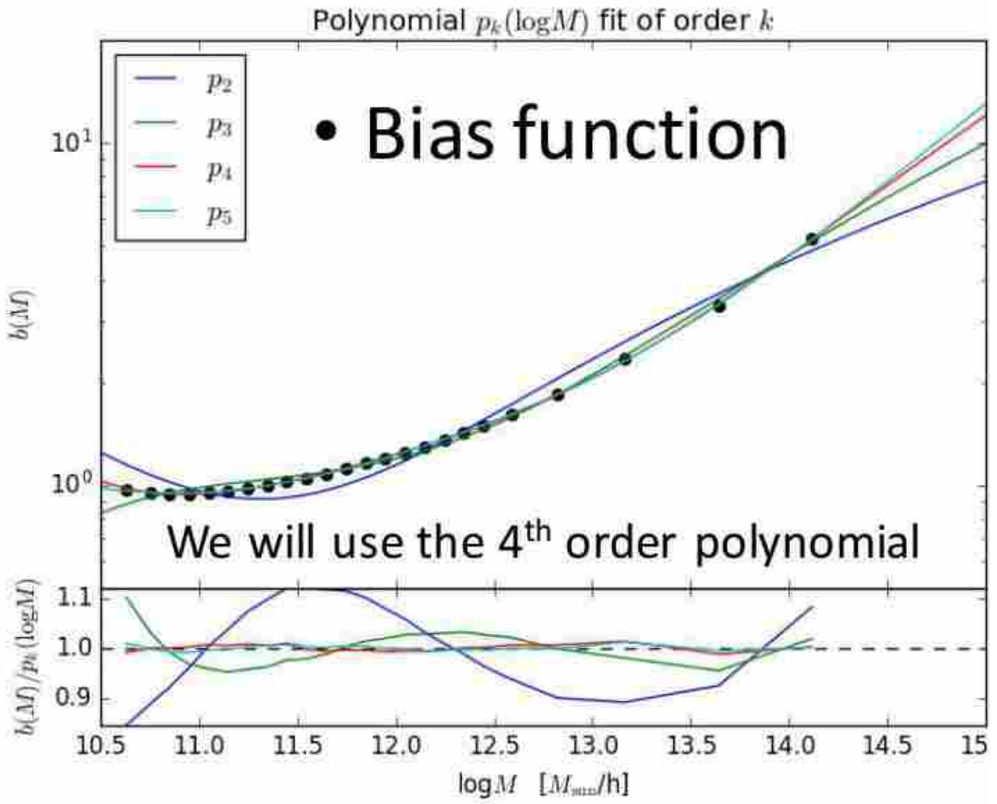
GALFORM informing HOD models,
work done in collaboration with Santiago Ávila.

OuterRim Simulation:

$$L = 3000\mathrm{Mpc}/h$$
$$N = 10240^3$$
$$m_{\mathrm{DM}} = 1.9 \times 10^9 M_{\mathrm{sun}}/h$$

Ω_{m}	0.272
Ω_{Λ}	0.728
Ω_{b}	0.0455
$h \equiv H_0/(100\ \mathrm{km\,s^{-1}\,Mpc^{-1}})$	0.71
σ_8	0.8
n_{s}	0.963





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GALFORM informing HOD models,
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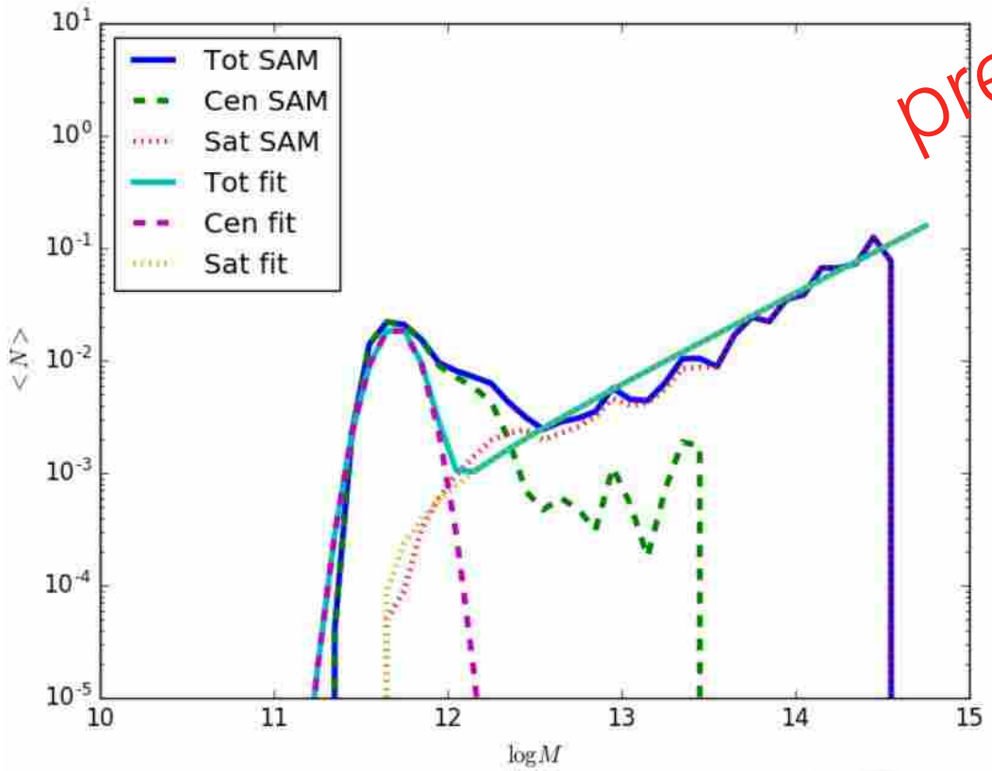
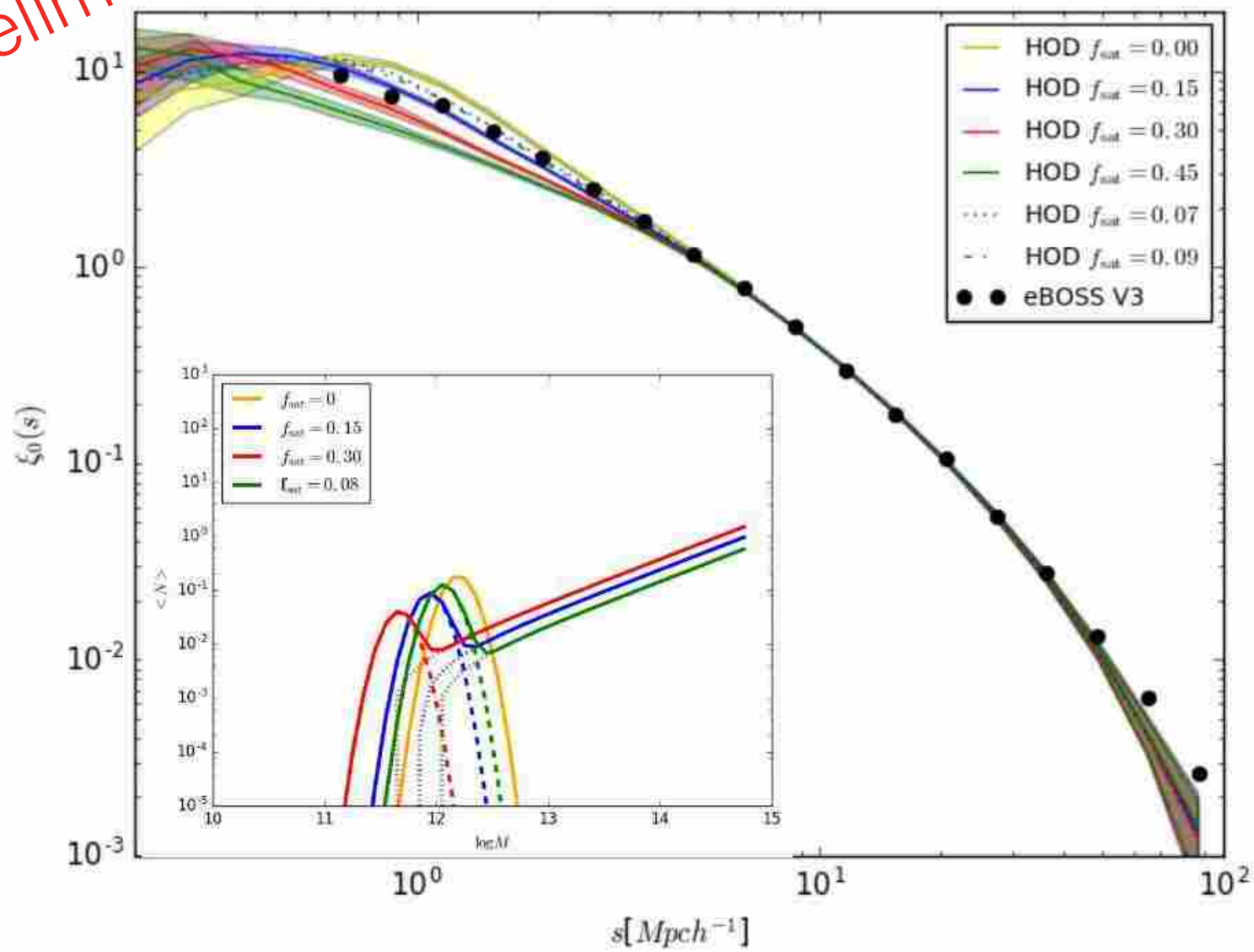
preliminary



$$< N_{cent} >= \frac{A_c}{\sqrt{2\pi\sigma^2}} \exp\{-\frac{(logM_h - \mu)^2}{2\sigma^2}\}$$

$$< N_{sat} >= A_s \left(\frac{M_h - M_0}{M_1}\right)^{\alpha}$$



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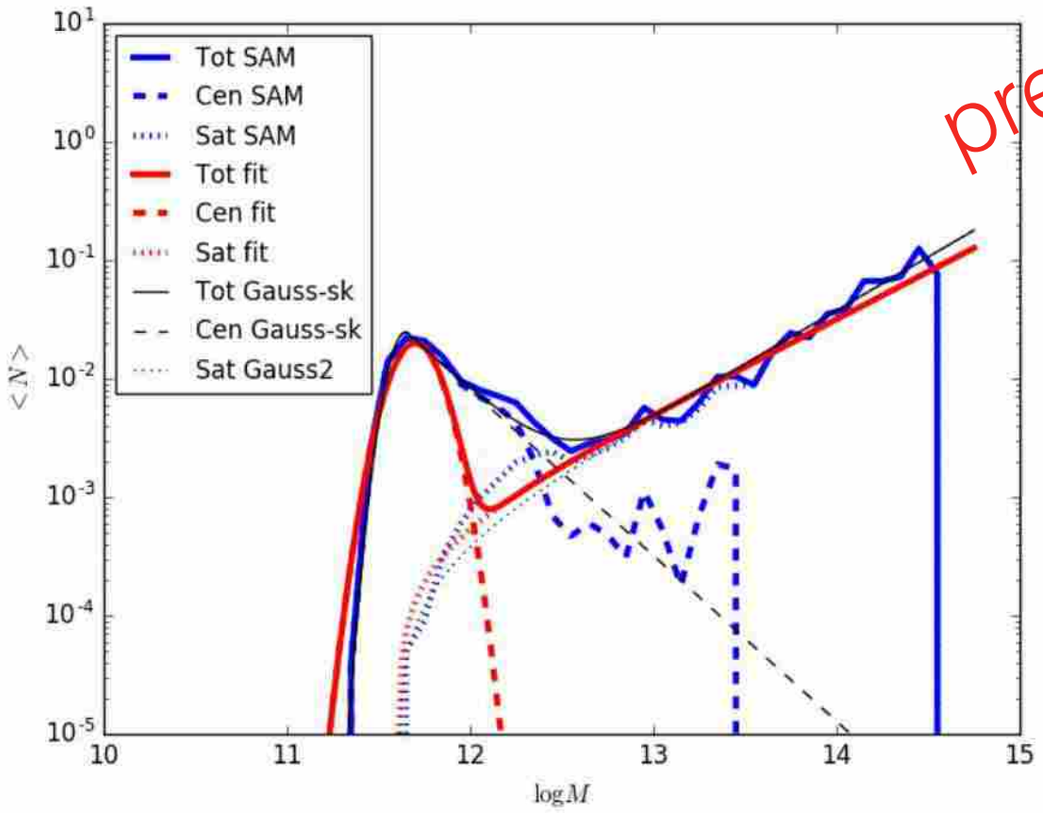
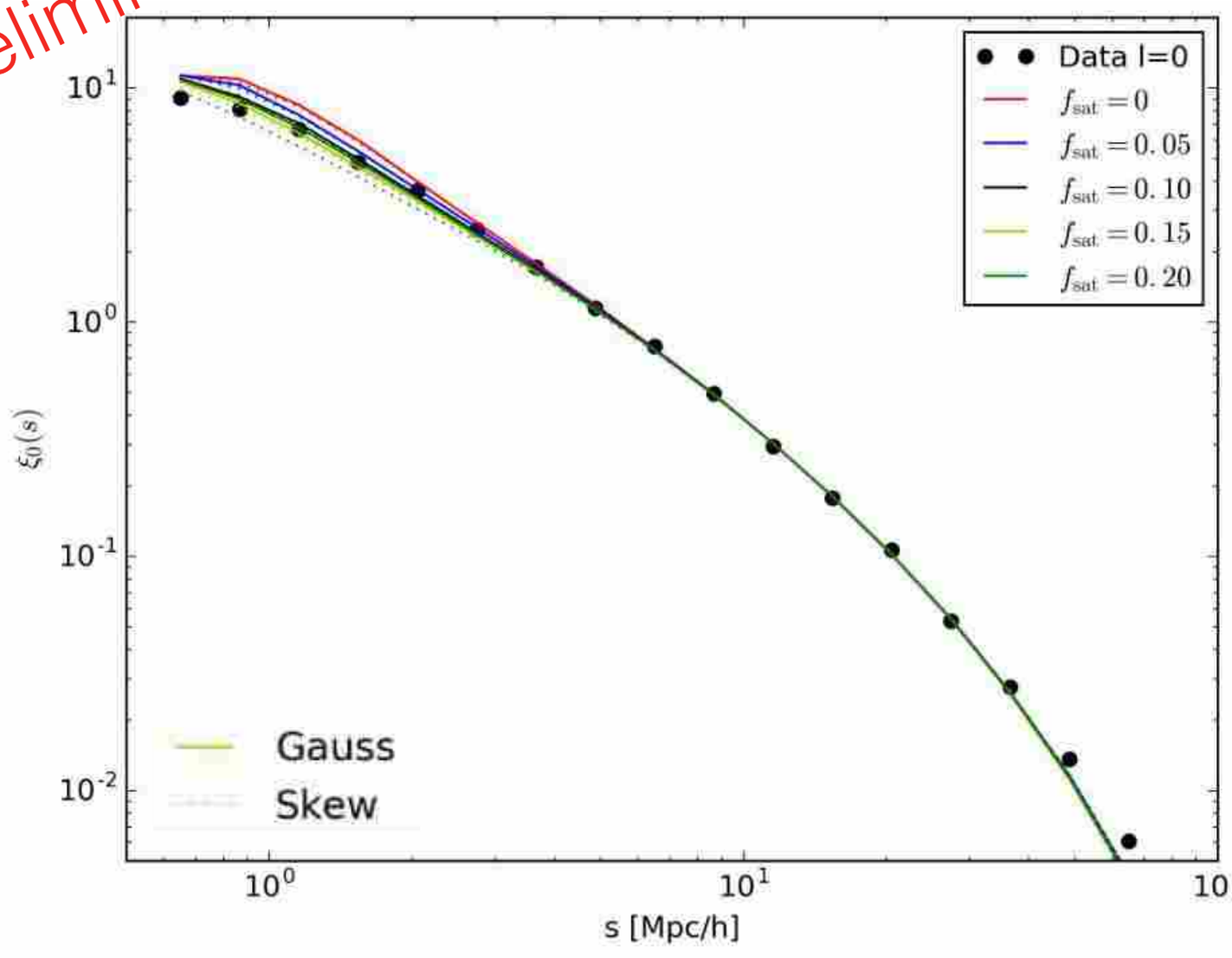


$$\langle N_{\rm cen}(M_h)\rangle = \begin{cases} \frac{A_c}{2\pi\sigma^2}\cdot e^{-\frac{(\log M_h-\mu)^2}{2\sigma^2}} & \text{if} \quad M_h < \mu \\ A_c\left(\frac{\log M_h}{\mu}\right)^{\gamma} & \text{if} \quad M_h > \mu \end{cases}$$



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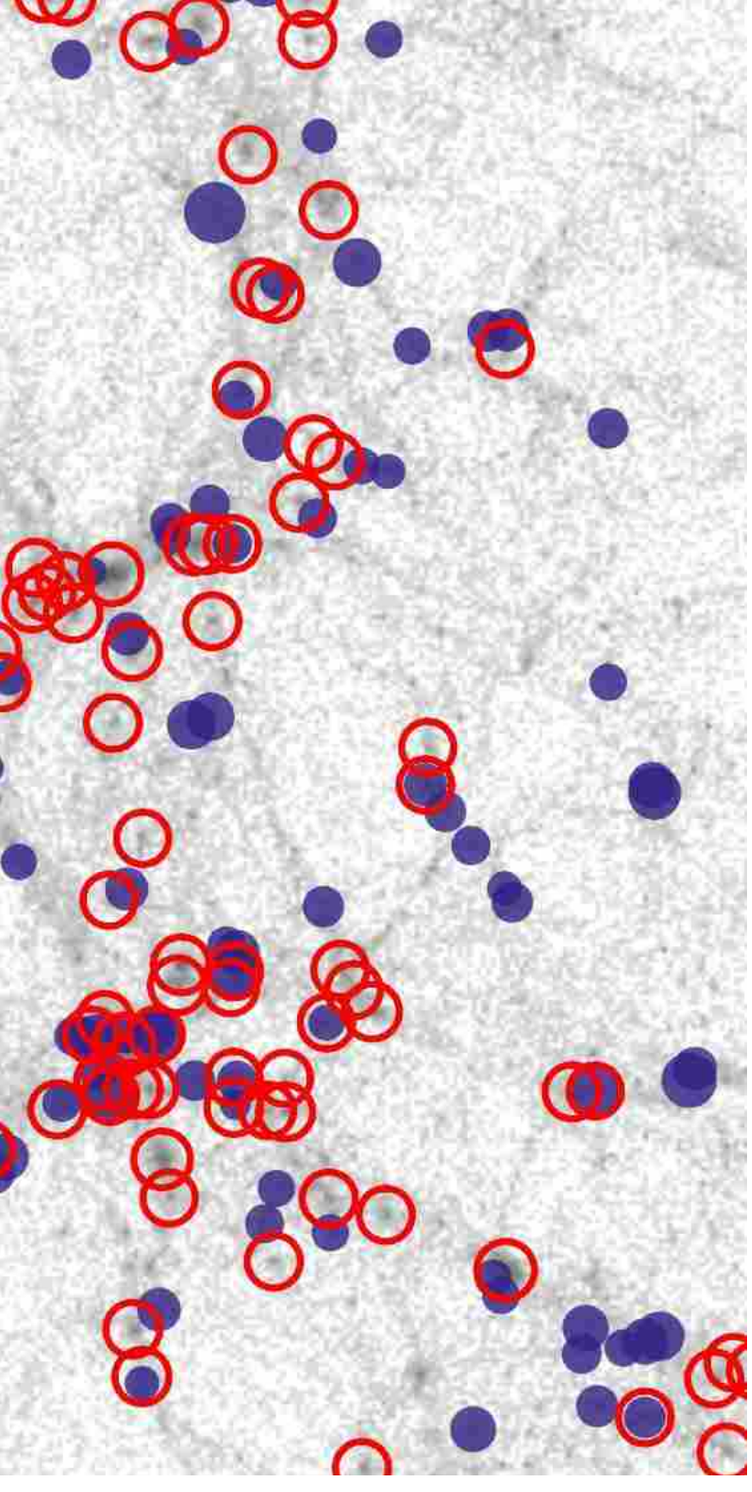

Conclusions:

- The mean halo occupation distribution of model [OII] emitters has a shape typical of that inferred for star-forming galaxies.
  This has cosmological implications.

- The [OII] luminosity is tightly correlated with SFR and the rest-frame UV bands.
  However, using these properties as proxies lead to expecting too many bright galaxies and a different clustering at small scales.

Gonzalez-Perez et al. 2018;
Favole, GP et al. in prep; Ávila, GP et al in prep