MODELING STAR FORMATION AND AGN ACTIVITY IN SUB-mJy RADIO SURVEYS

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-Bologna, 22nd October 2015-

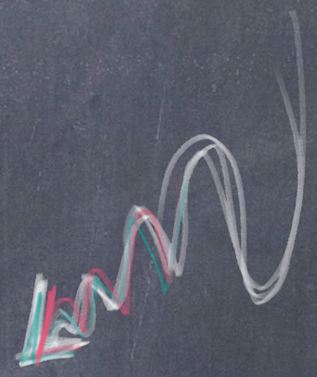
Which are sub-mJy sources?

Star-forming Galaxies

Synchrotron emission via relativistic plasma from supernovae

1.4 GHz

AGNs



Radio Loud

Synchrotron emission from gravitational energy of SMBHs in the form of jets

Radio Quiet

?

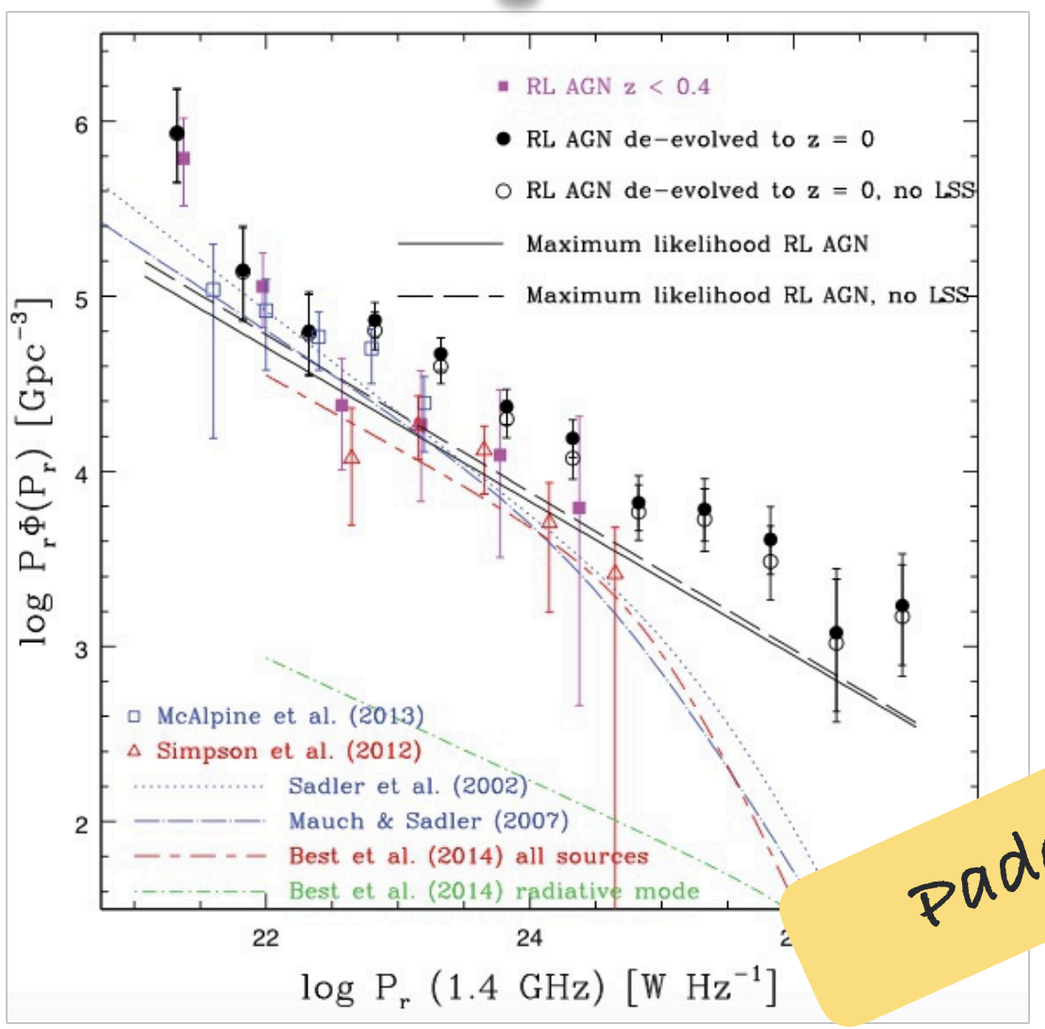
Radio Quiet AGNs

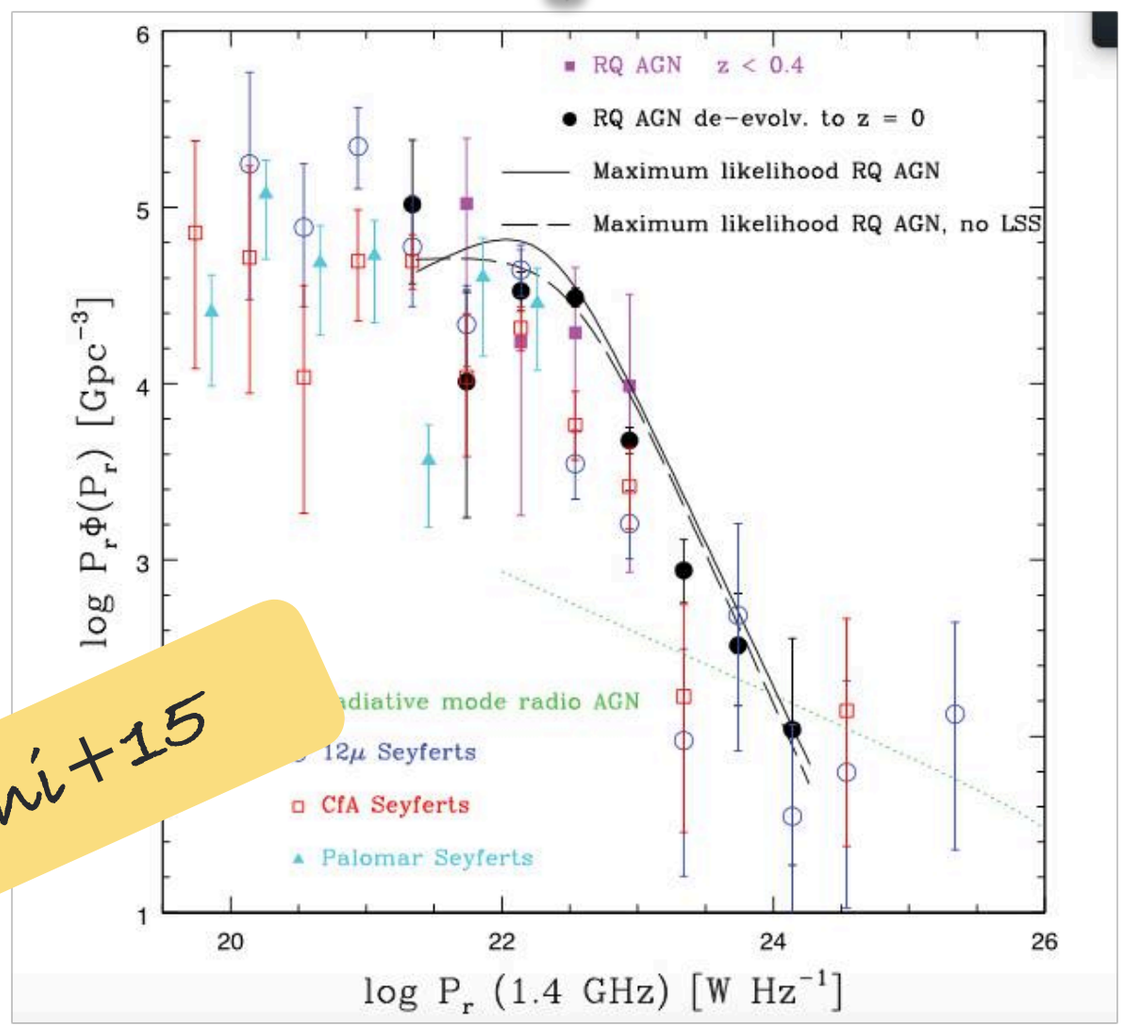
Rescaled version of
Radio Loud AGNs

RQ luminosity
function is
extrapolated from
RLs one

Radio Quiet AGNs

Rescaled version of Radio Loud AGNs

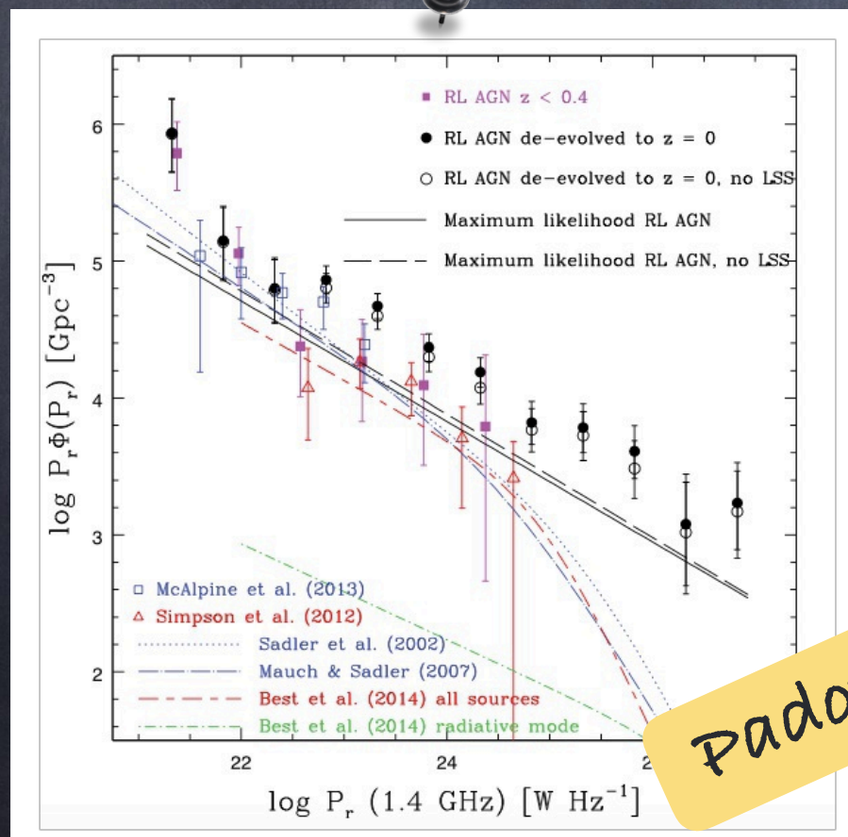


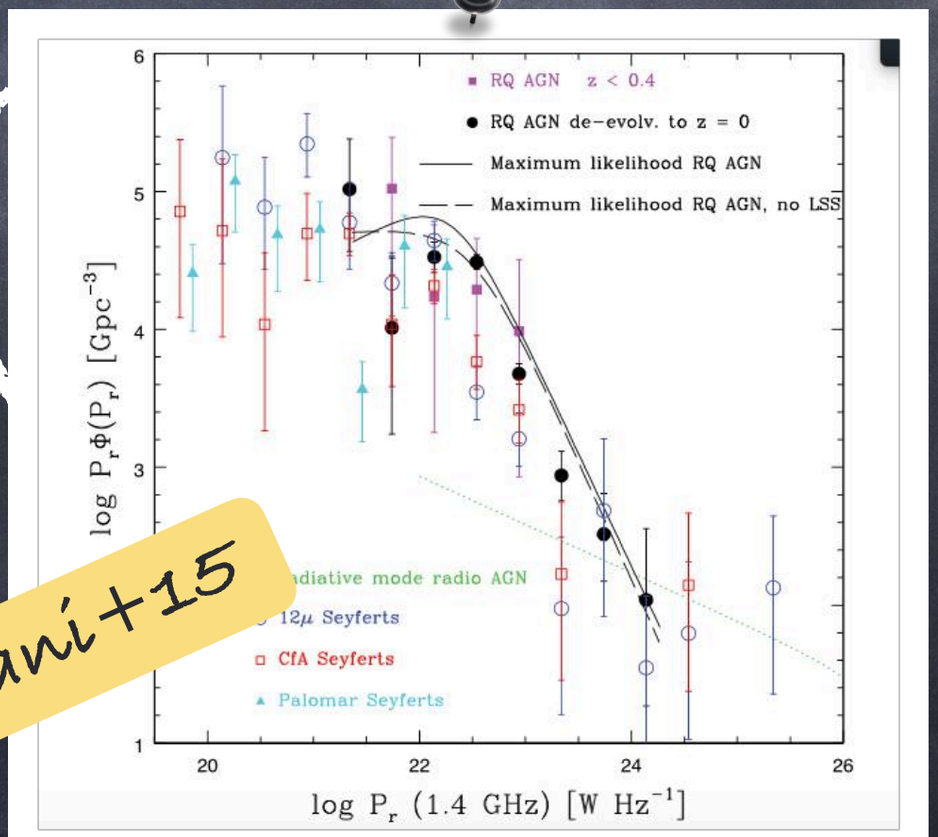


Padovani+15

Radio Quiet AGNs

Rescaled version of
Radio Loud AGNs





Padovani+15

Radio Quiet AGNs

Bimodality with
Radio Loud AGNs

- Different physical processes

- Different geometries

Radio Quiet AGNs

Bimodality with Radio Loud AGNs

- Different physical processes
- Different geometries

RLs dominated by non-thermal emission (jets)

RQs dominated by thermal emission (accretion disk)

Radio Quiet AGNs

Total power in RQ AGNs

Accretion onto BH

What about radio power?

Star formation

Modeling Star Forming Galaxies

physical, forward model
HIGH REDSHIFT
(z>1)

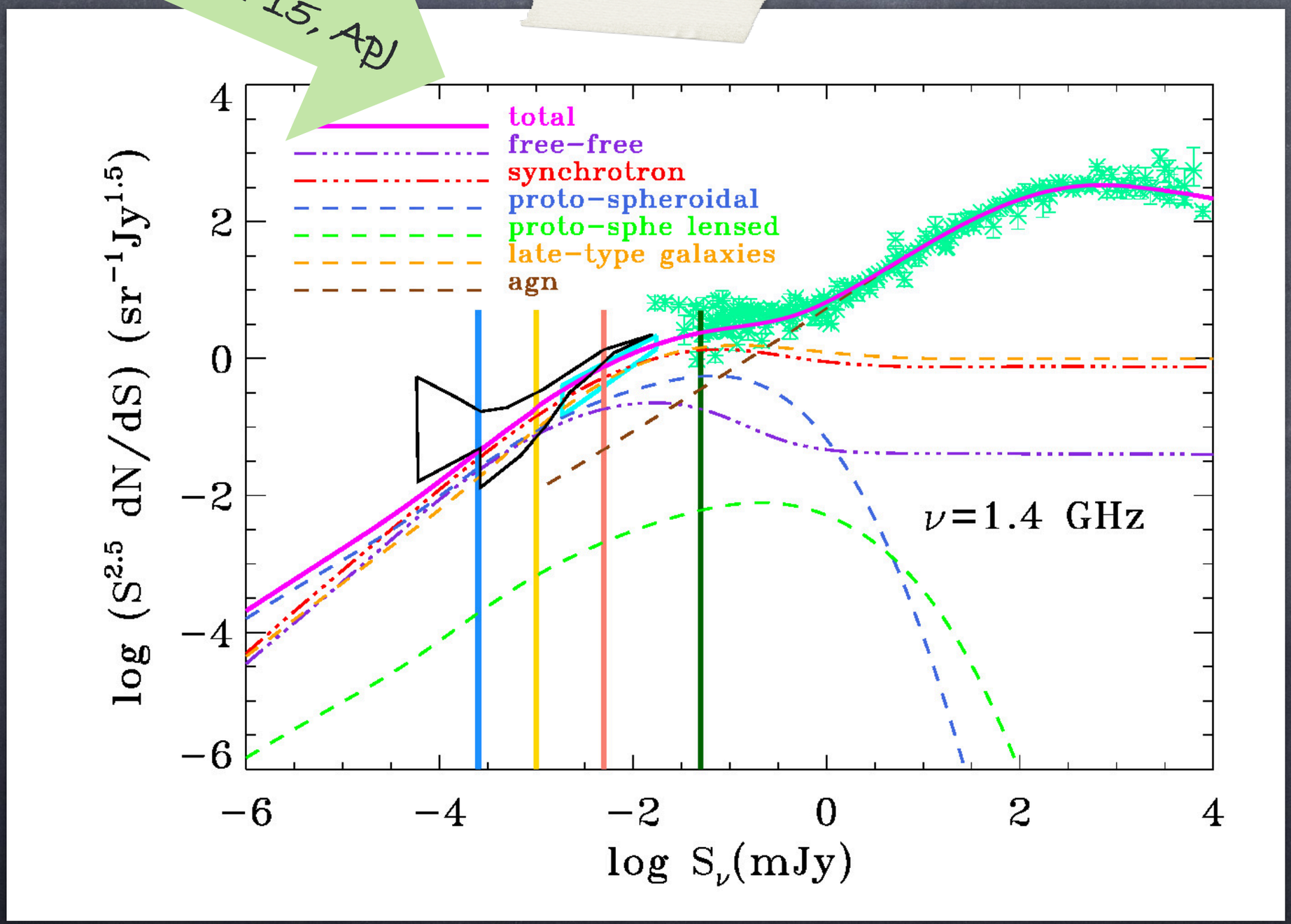
phenomenological, backward approach
LOW REDSHIFT
(z<1)

UV + IR
Star Formation Rate functions

Radio Luminosity functions → number counts

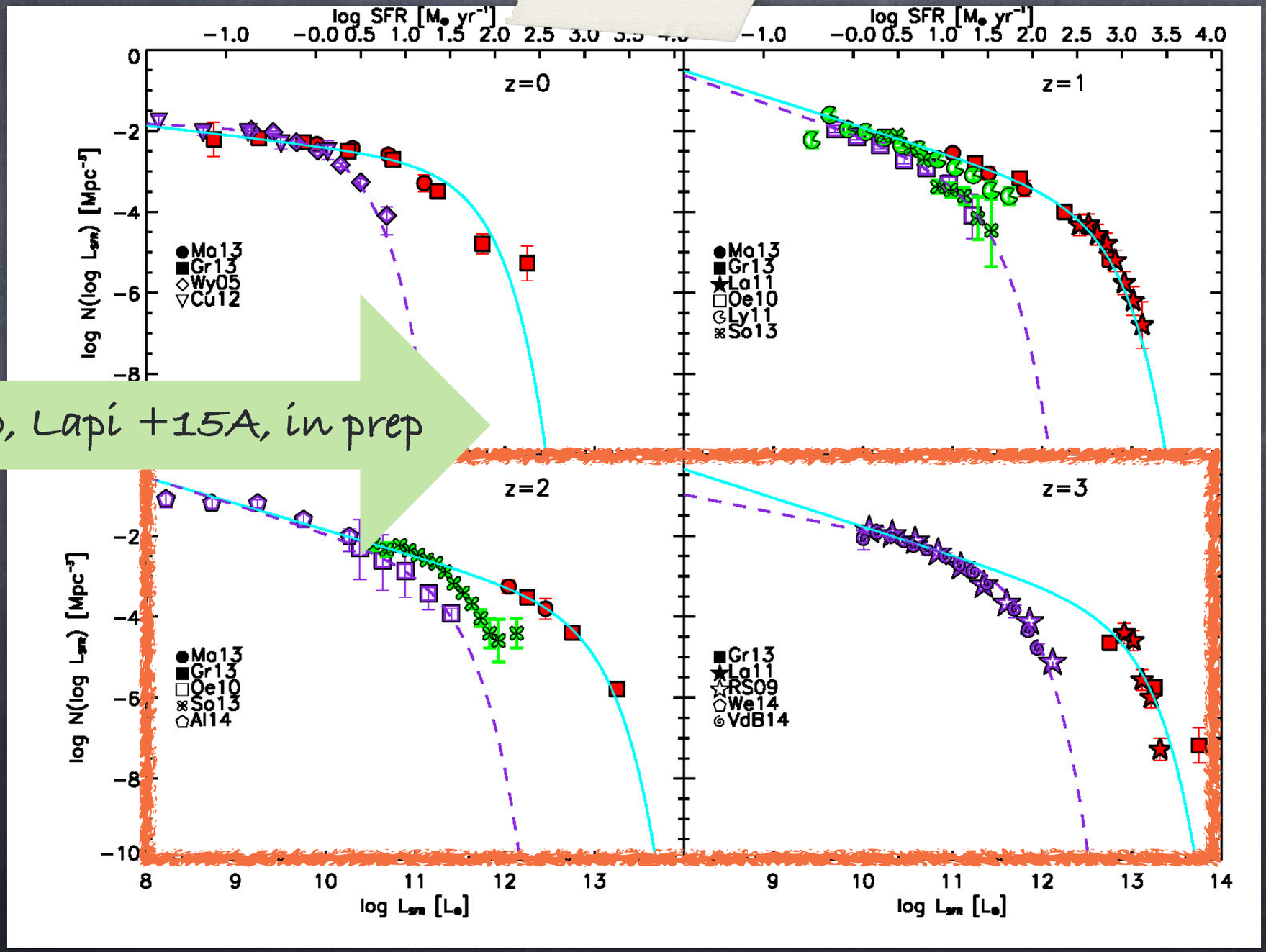
Modeling Star Forming Galaxies

Mancuso, Lapi +15, ApJ



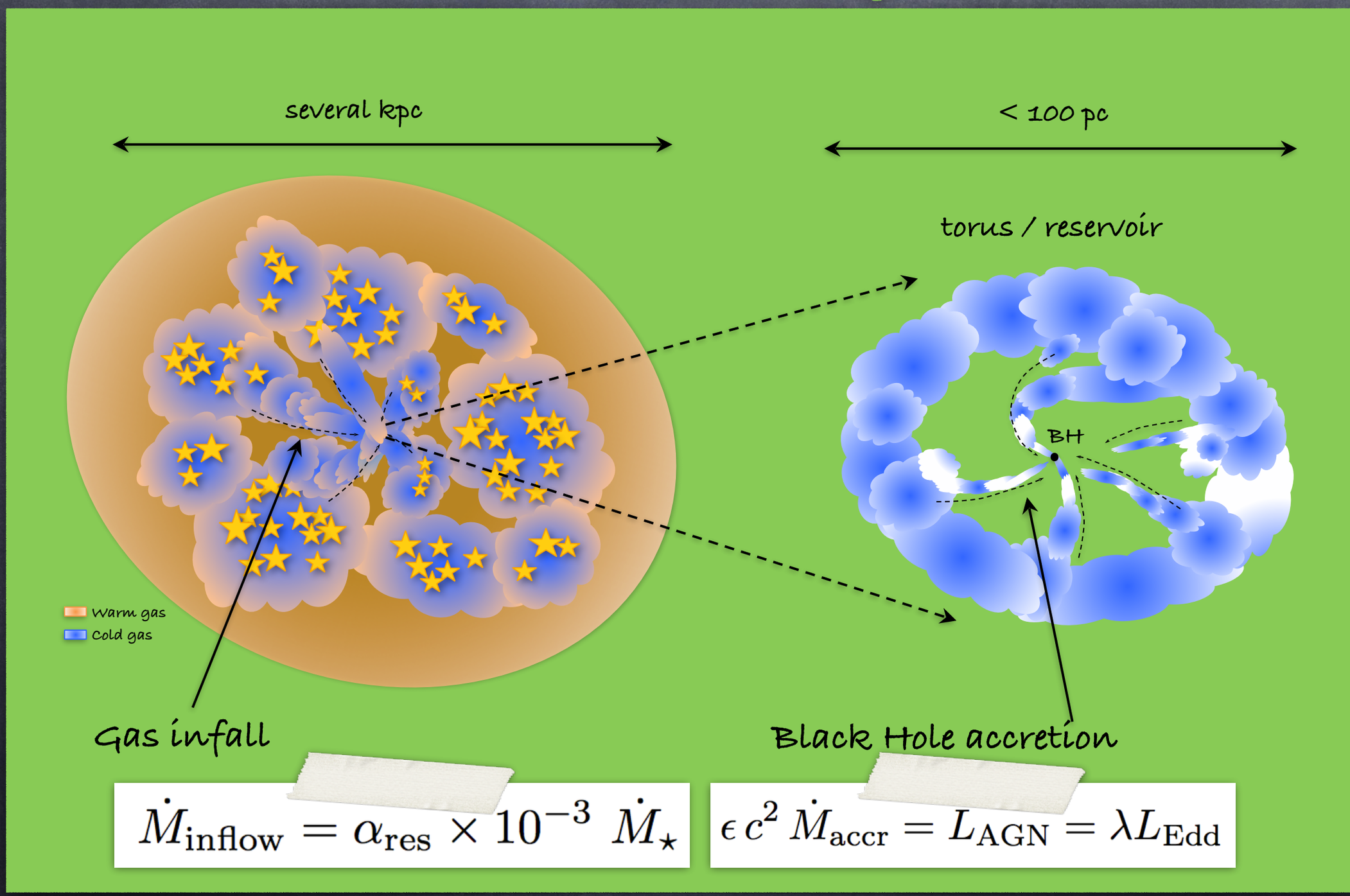
See poster

Modeling Star Forming Galaxies: high-z



Mancuso, Lapi +15A, in prep

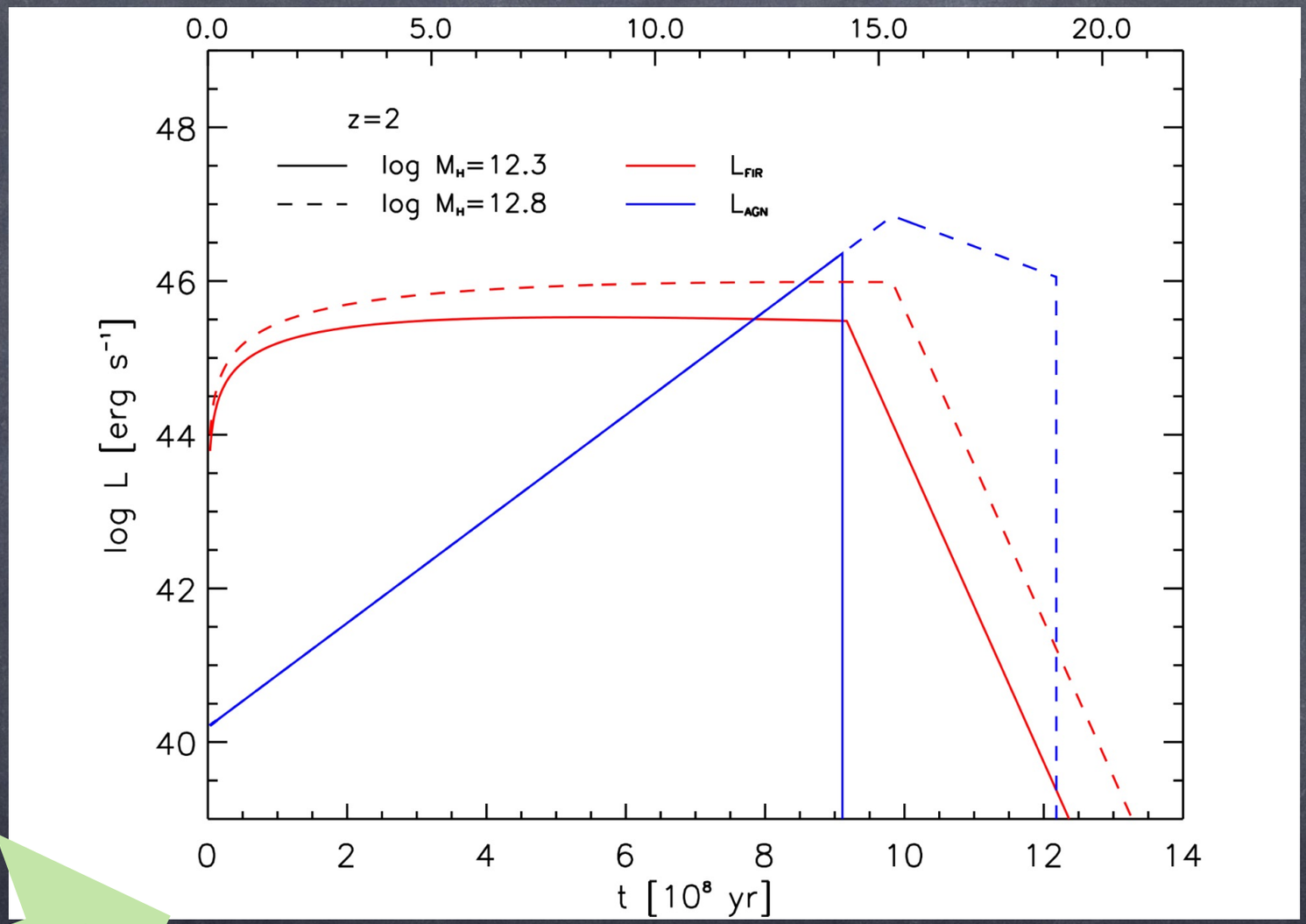
Modeling Star Forming Galaxies: high-z



$$\dot{M}_{\rm inflow} = \alpha_{\rm res} \times 10^{-3}\ \dot{M}_{\star}$$

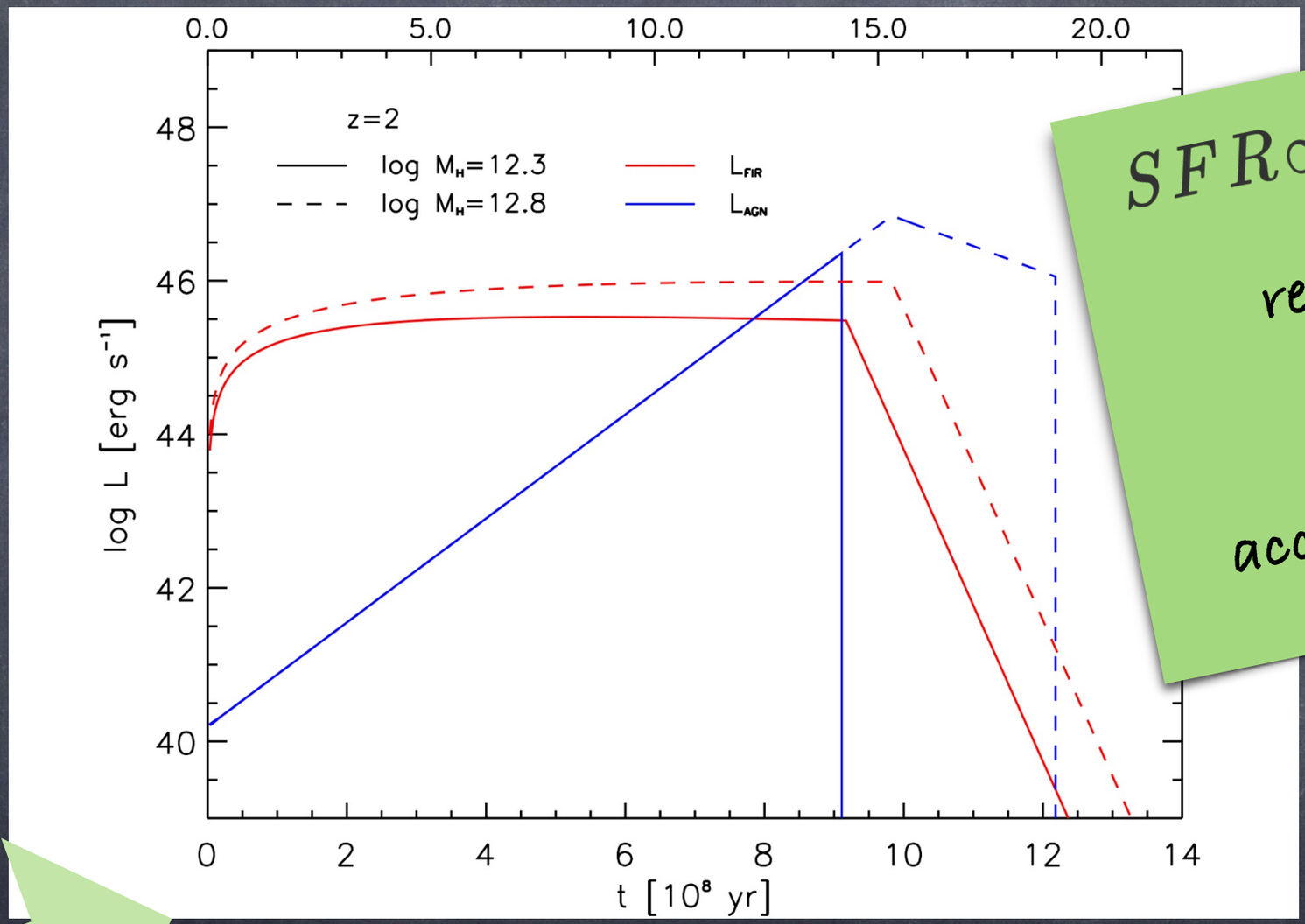
$$\epsilon\, c^2\, \dot{M}_{\rm accr} = L_{\rm AGN} = \lambda L_{\rm Edd}$$

Modeling Star Forming Galaxies: high-z



Lapi+14, ApJ

Modeling Star Forming Galaxies: high-z



$SFR \propto M_{reservoir}$

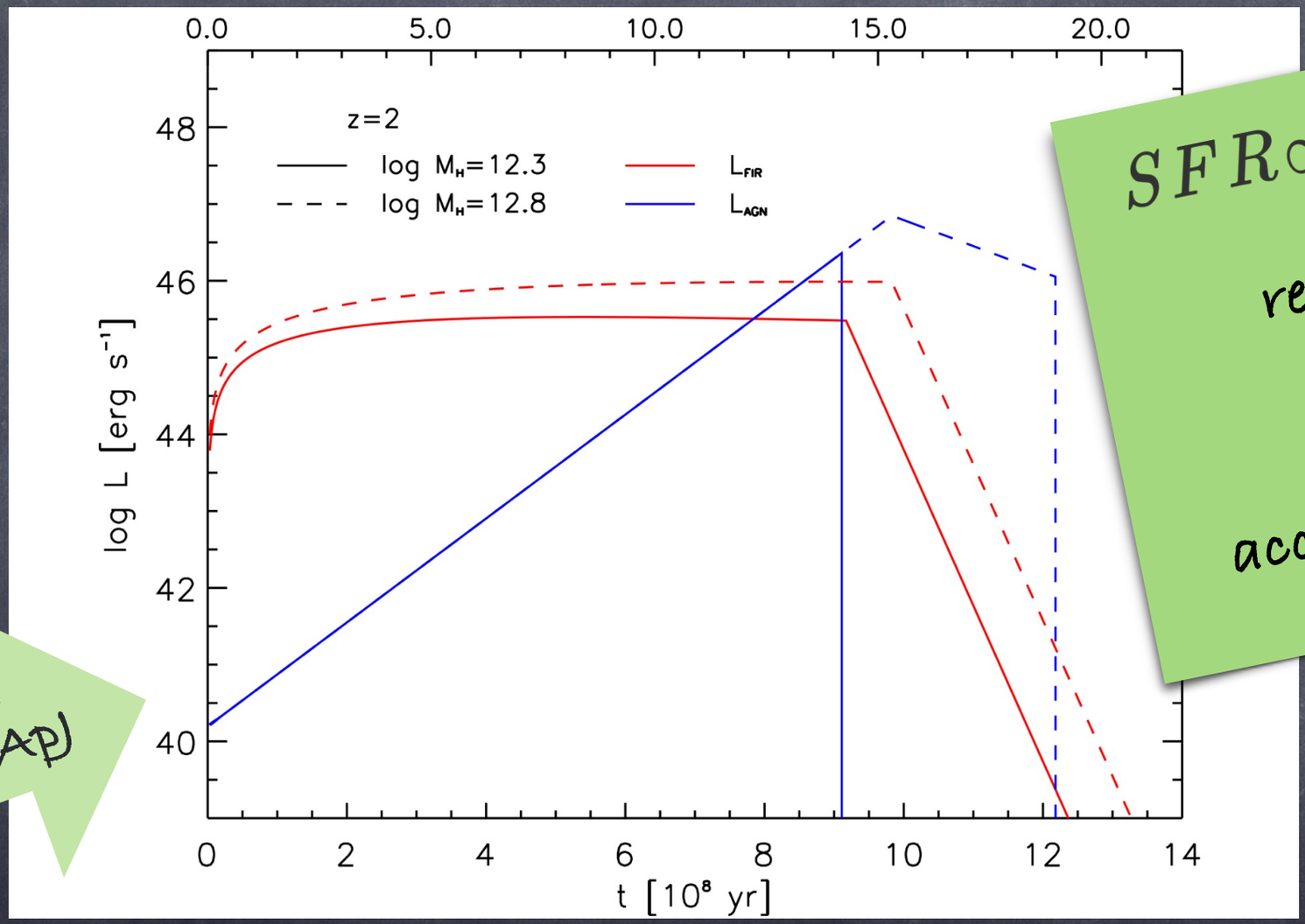
reservoir

accretion disk

Lapi+14, ApJ

SFR $\not\propto$ accretion rate

Modeling Star Forming Galaxies: high-z



$SFR \propto M_{reservoir}$

reservoir

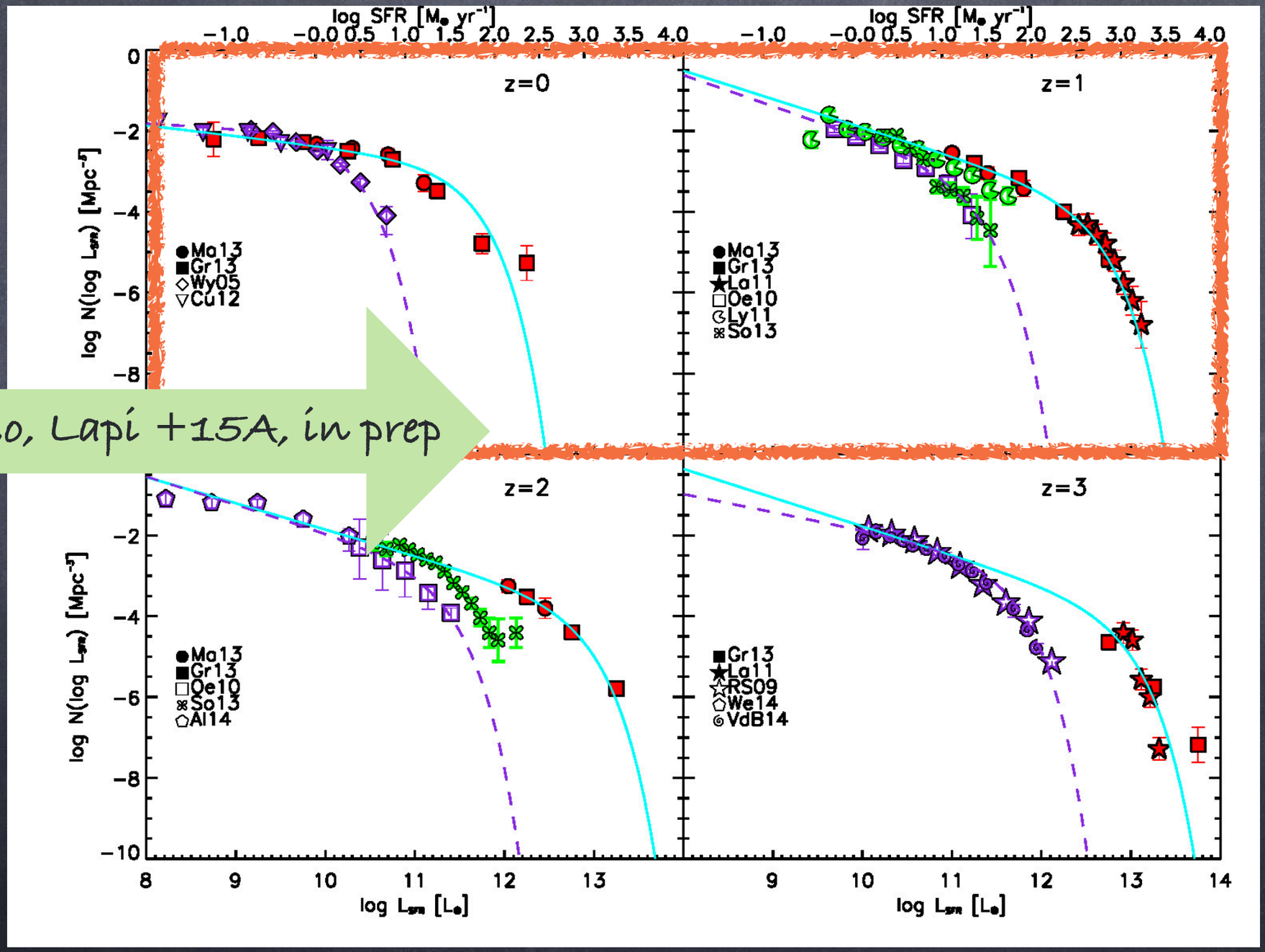
accretion disk

Lapi+14, ApJ

Lightcurves timescales ⇨

⇨ P(AGN) inside SF galaxy

Modeling Star Forming Galaxies: low-z



Mancuso, Lapi +15A, in prep

Modeling Star Forming Galaxies: low-z

observed star formation rate functions (IR+UV)

observed proportionality between the mass in stars and the BH mass

Following Bonato et al. 2014 on the sample of Chen et al. 2013

Modeling Star Forming Galaxies + RQ AGN: low-z

Probability of having an AGN inside the star forming galaxy

Gaussian distribution

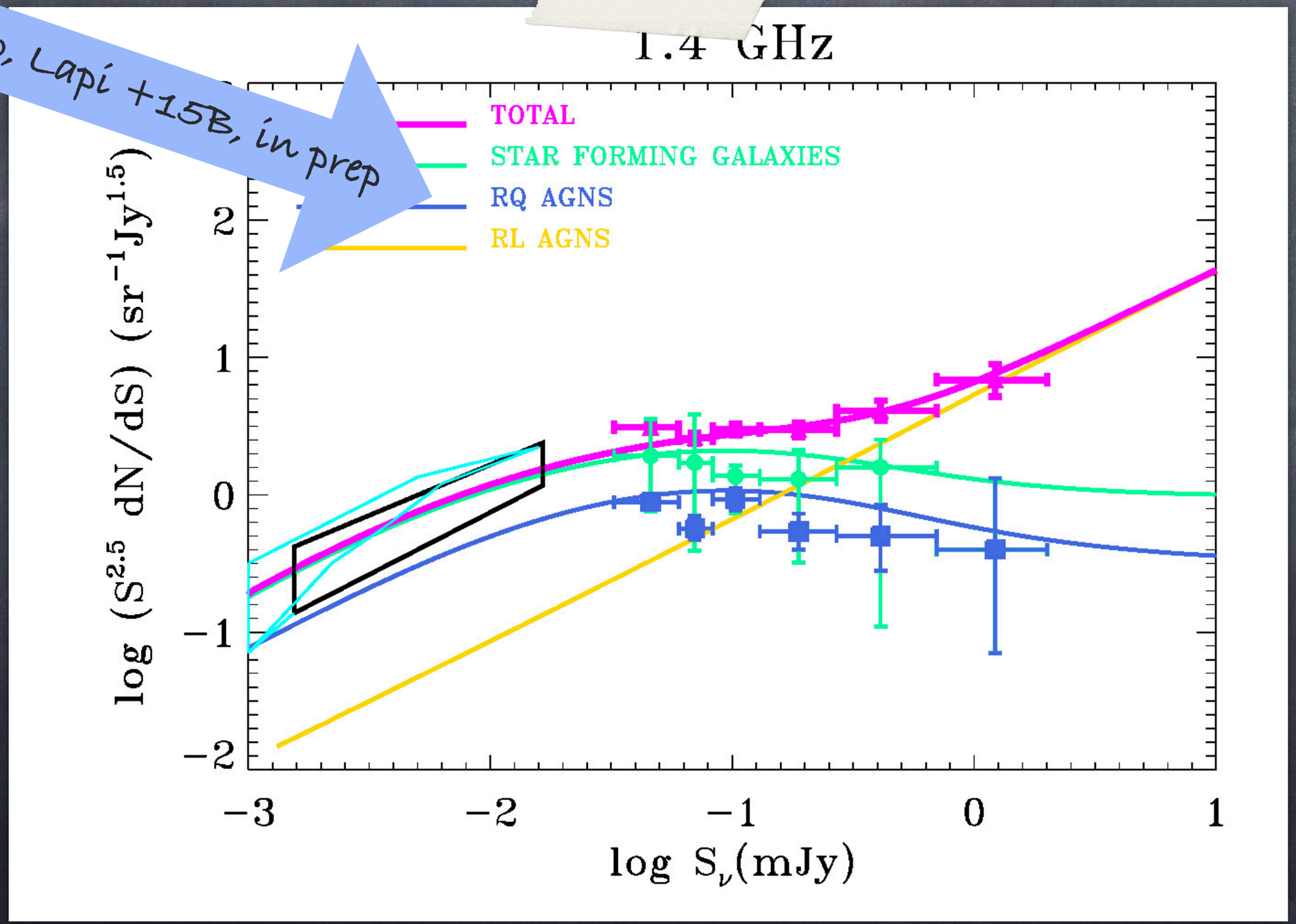
Mean=

$$\left\langle \frac{L_{bol}}{L_{ir}} \right\rangle = 0.054 \left(L_{ir} / 10^{12}\, L_{\odot} \right)^{0.05}$$

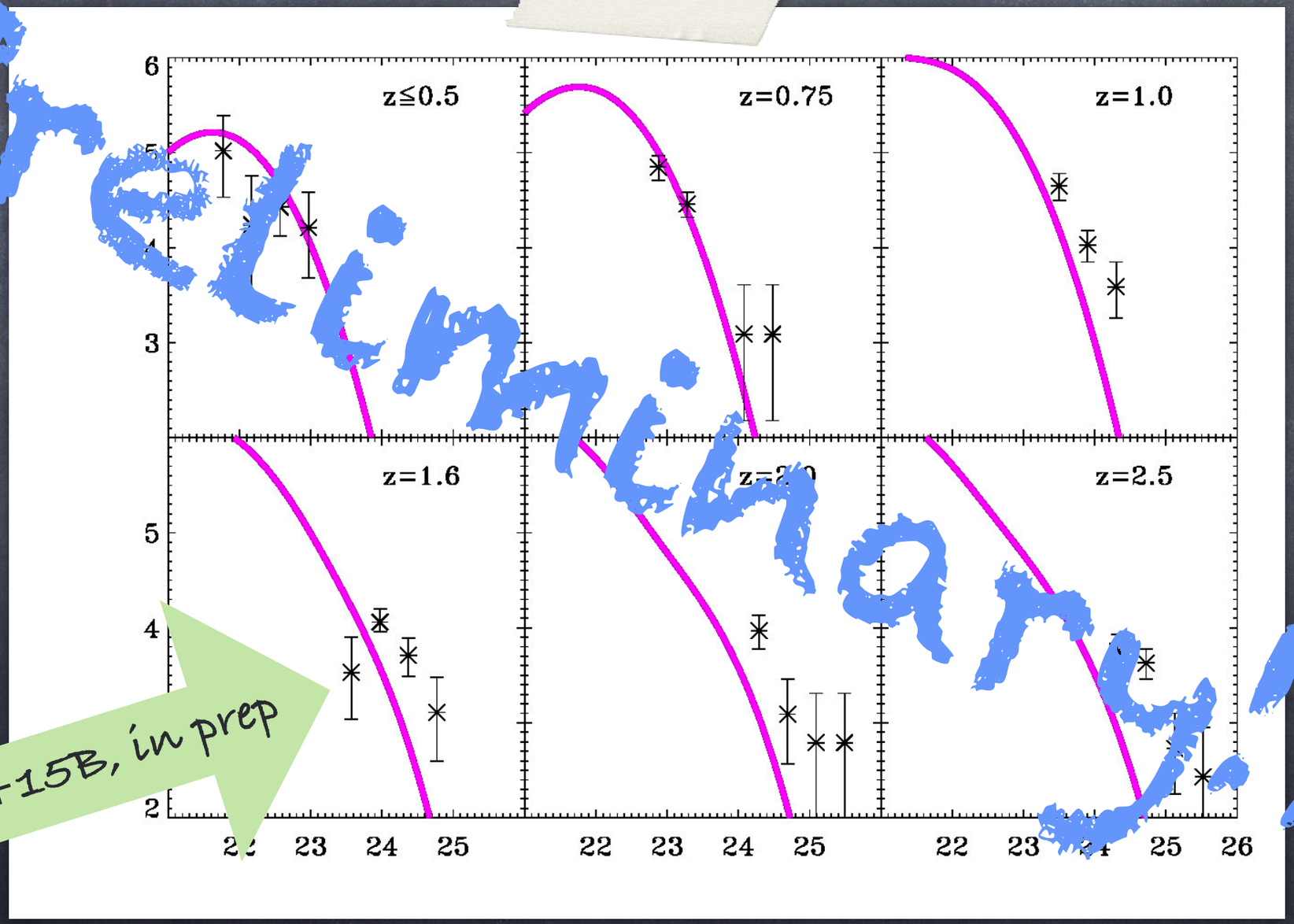
sigma=0.69

Number counts: Radio Quiet AGNs

Mancuso, Lapi +15B, in prep



Luminosity functions: Radio Quiet AGNs & star formation



Preliminary!!!

Mancuso, Lapi +15B, in prep

Conclusions & future plans

- Basing on a state of the art galaxy/BH coevolution model vs the observed sub-mJy cts at 1.4 GHz, we statistically confirmed that the radio emission from radio quiet AGNs is mainly due to star formation

- We are currently working to predict the redshift evolution of RQ luminosity function

Conclusions & future plans

- We have in plan to extend predictions to higher frequencies

- We want to investigate the location of sf galaxies and RQ AGNs on the SFR-Mstar and Lagn-SFR planes, as a test of the underlying coevolution model

Thank you!