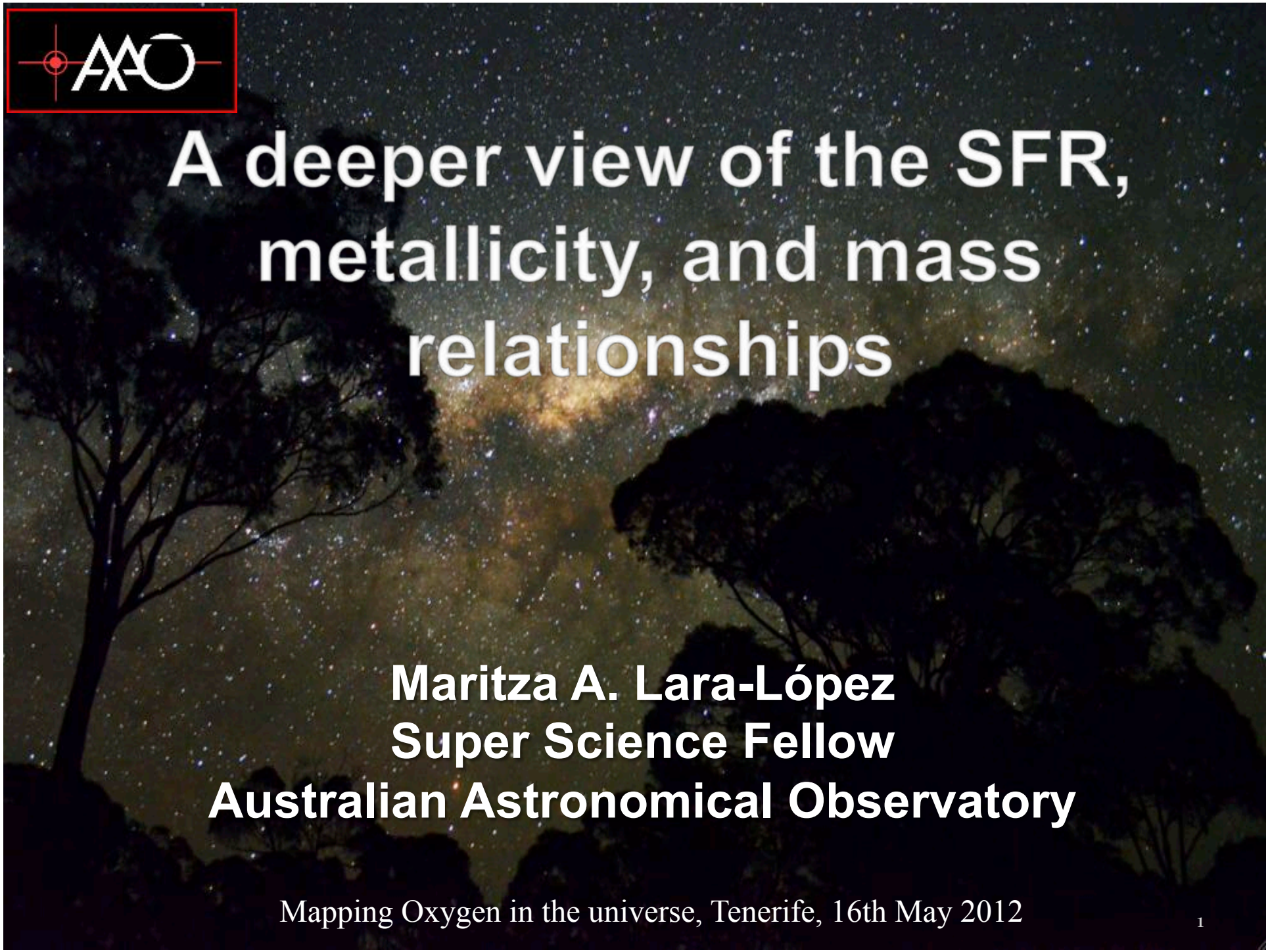
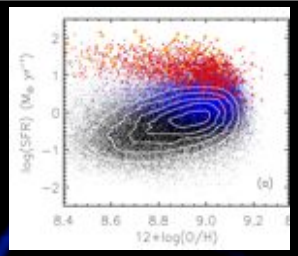


# A deeper view of the SFR, metallicity, and mass relationships

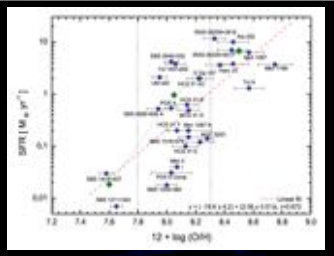
**Maritza A. Lara-López**
**Super Science Fellow**
**Australian Astronomical Observatory**

Mapping Oxygen in the universe, Tenerife, 16th May 2012

# A fundamental plane for field galaxies



Lara-López et al. (2010)



López-Sánchez (2010)

Z-SFR

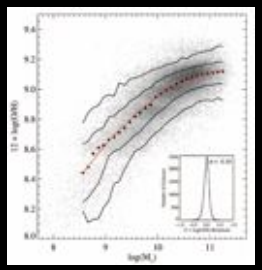
Metallicity

SFR

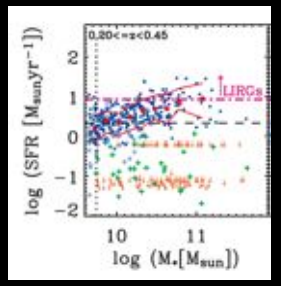
M-Z

M-SFR

Stellar Mass



Tremonti et al. (2004)




Noeske et al. (2007)

# A fundamental plane for field galaxies

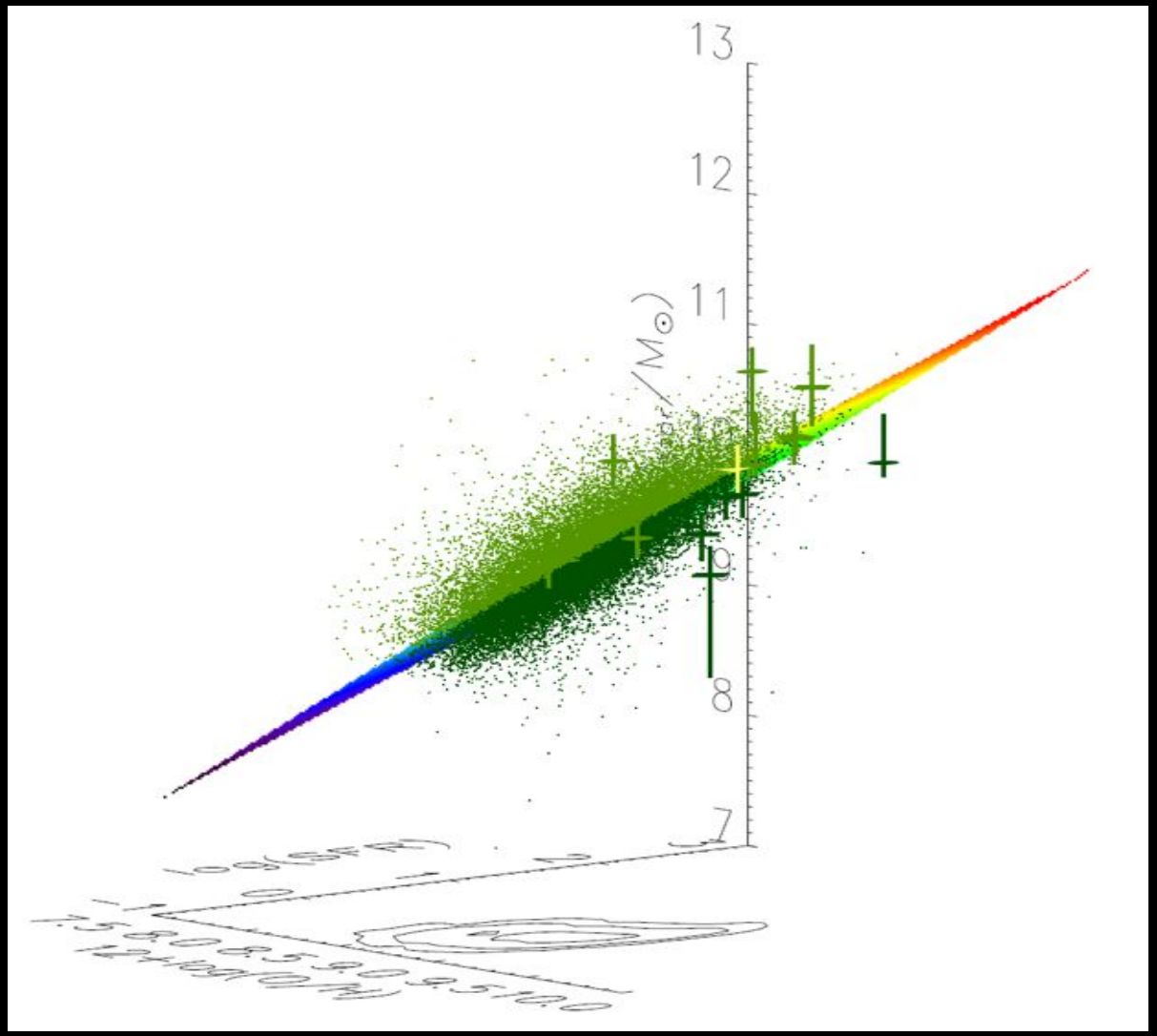
Diamonds: Erb et al. (2006) a z~2.2

Círcles: Maiolino et al. (2008) a z~3.5

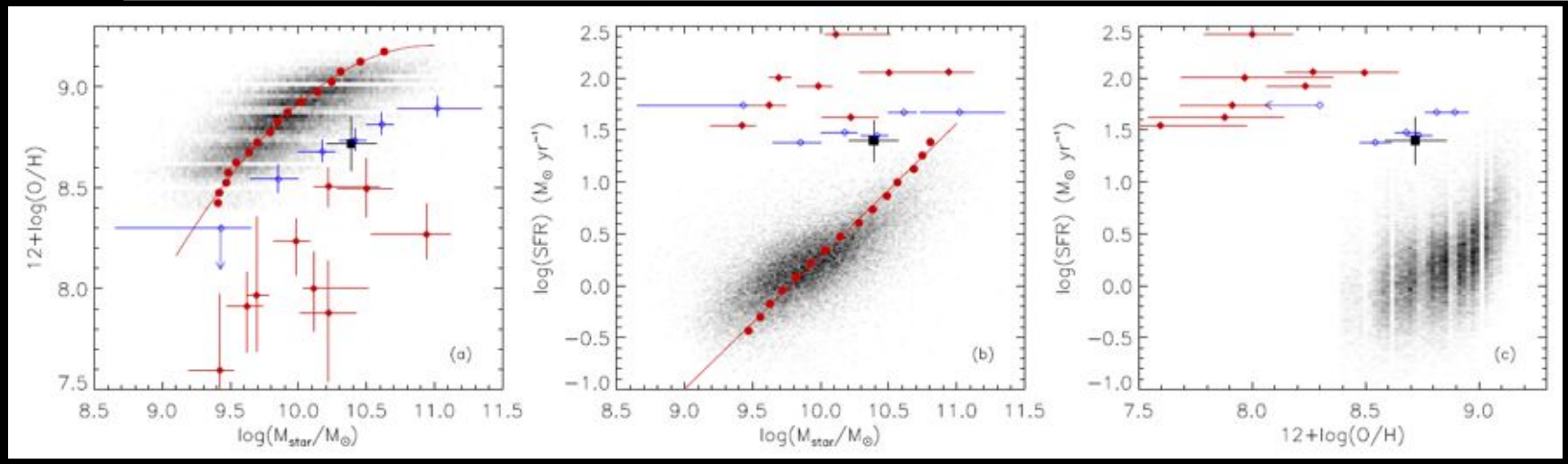
Triangles: Rodrigues et al. (2008) a z~0.85

Dots: SDSS a z~0.07

Lara-López et al. (2010)

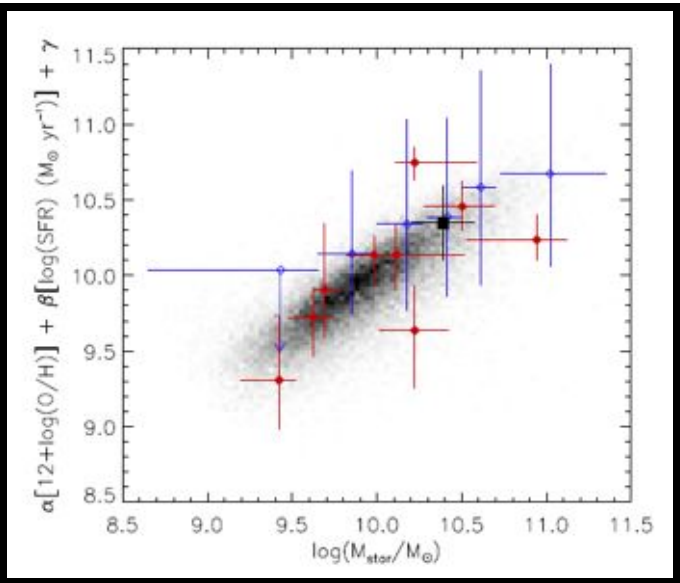


# A fundamental plane for field galaxies



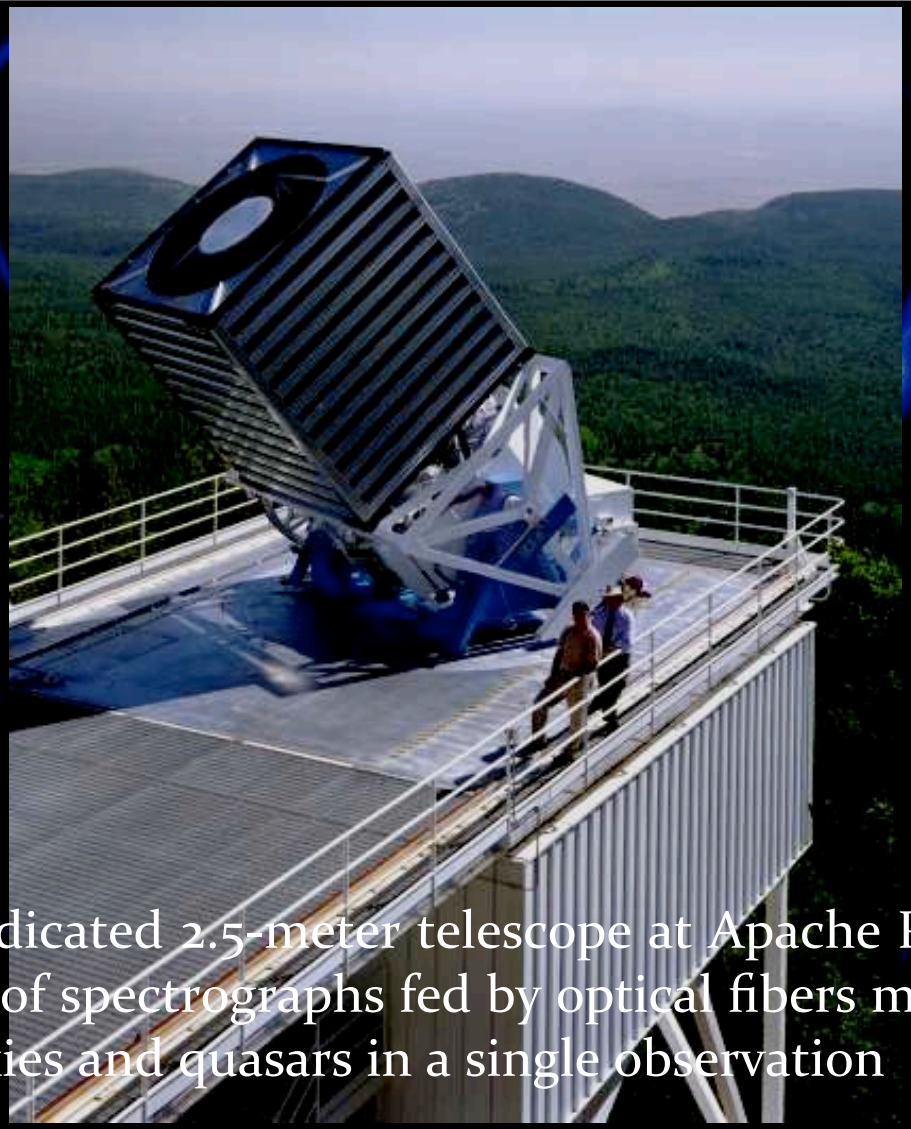

$$\log(M_{star}/M_{\odot}) = \alpha\,[12 + \log(O/H)] + \beta\,[\log(SFR)\,(M_{\odot}yr^{-1})] + \gamma$$

α=1.122
β=0.474
γ=-0.097




Lara-López et al. (2010)

# The Sloan Digital Sky Survey (SDSS)



The SDSS used a dedicated 2.5-meter telescope at Apache Point Observatory, New Mexico. A pair of spectrographs fed by optical fibers measured spectra of more than 600 galaxies and quasars in a single observation

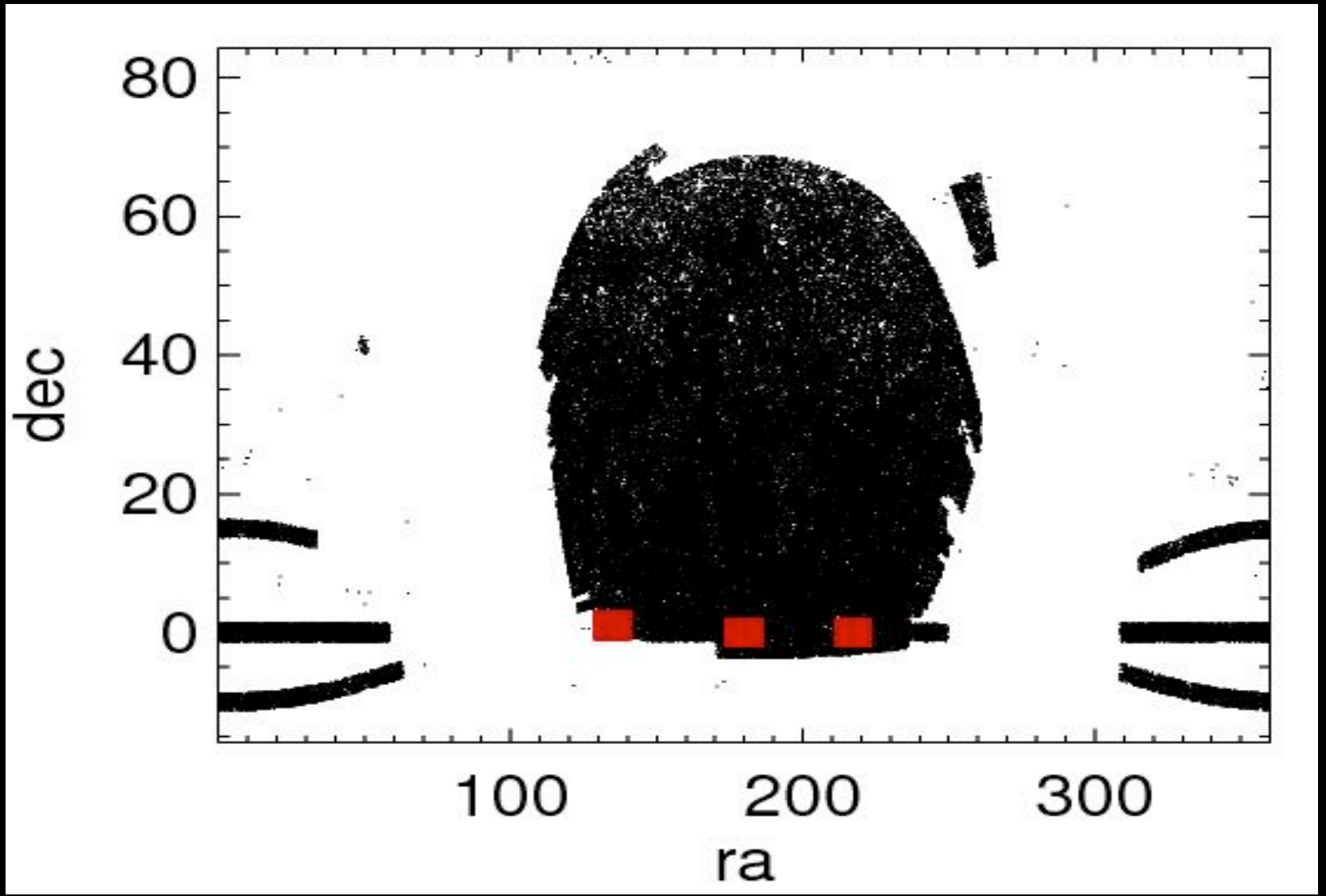
# The GAMA (Galaxy And Mass Assembly) Survey

http://www.gama-survey.org/

The Anglo-Australian Telescope (AAT)

3.9m telescope

# SDSS + GAMA



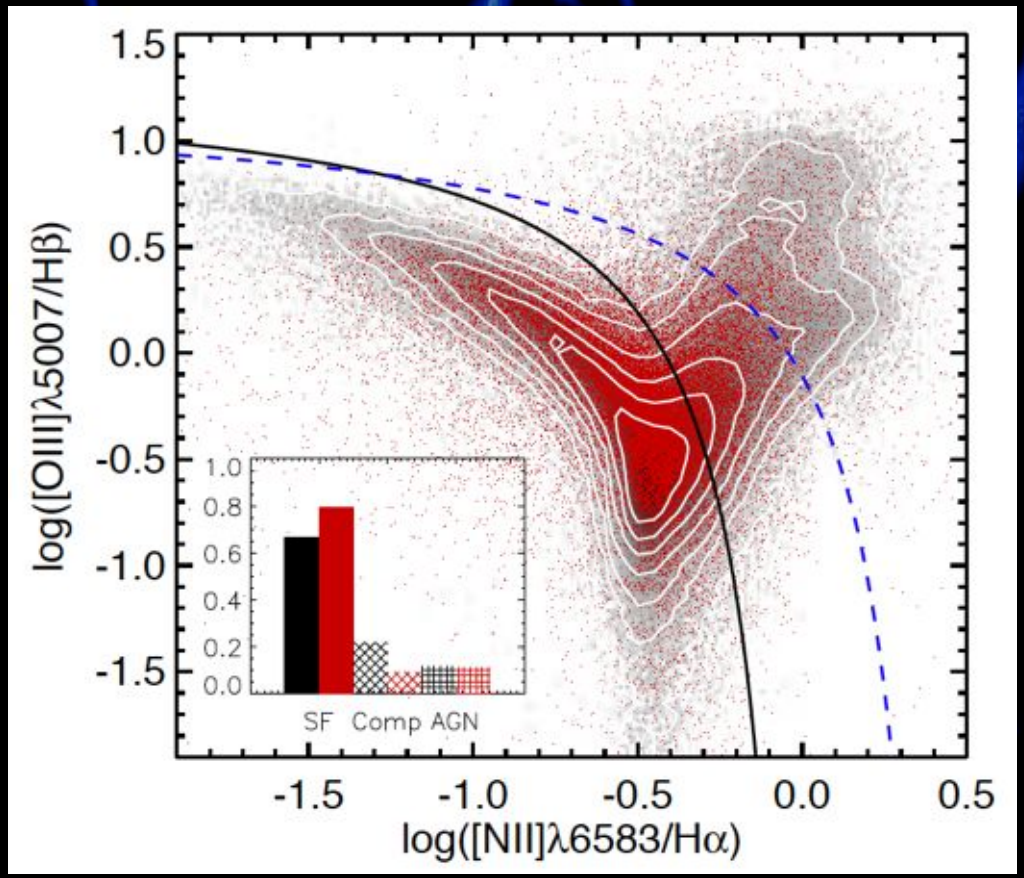
# The data

- SDSS-DR7 (Adelman-McCarthy et al. 2007)
  MPA-JHU data
  - SFRs: Brinchmann et al. (2004, B04)
  - Metallicities: Tremonti et al. (2004, T04)
  - Stellar masses: Kauffmann et al. (2003, K03)

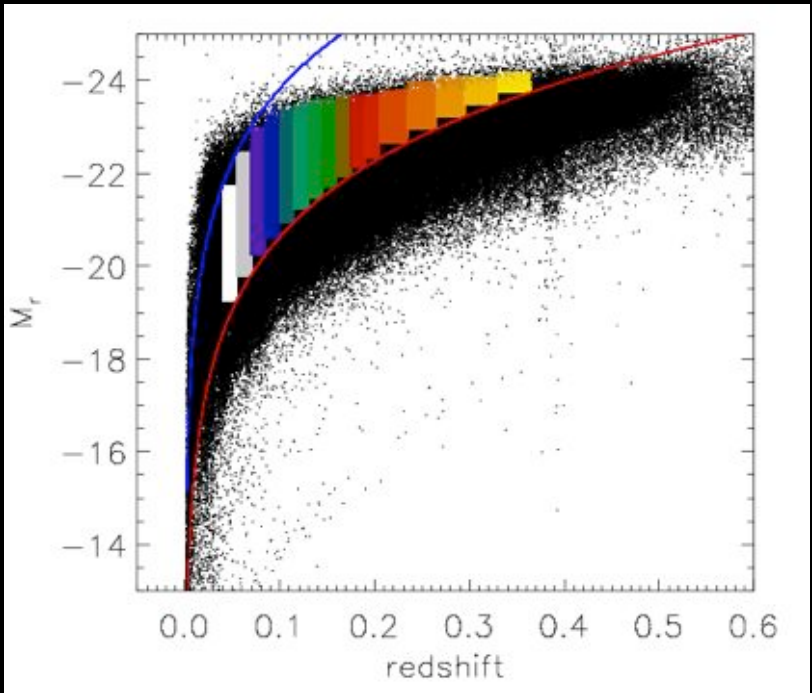
- GAMA survey (Baldry et al. 2010; Robotham et al. 2010)
  GANDALF
  - SFRs: Hopkins et al. (2003) & recalibrated to B04
  - Metallicities: Pettini & Pagel (2004) & recalibrated to T04
  - Stellar Masses: Taylor et al. (2011)

# Sample selection

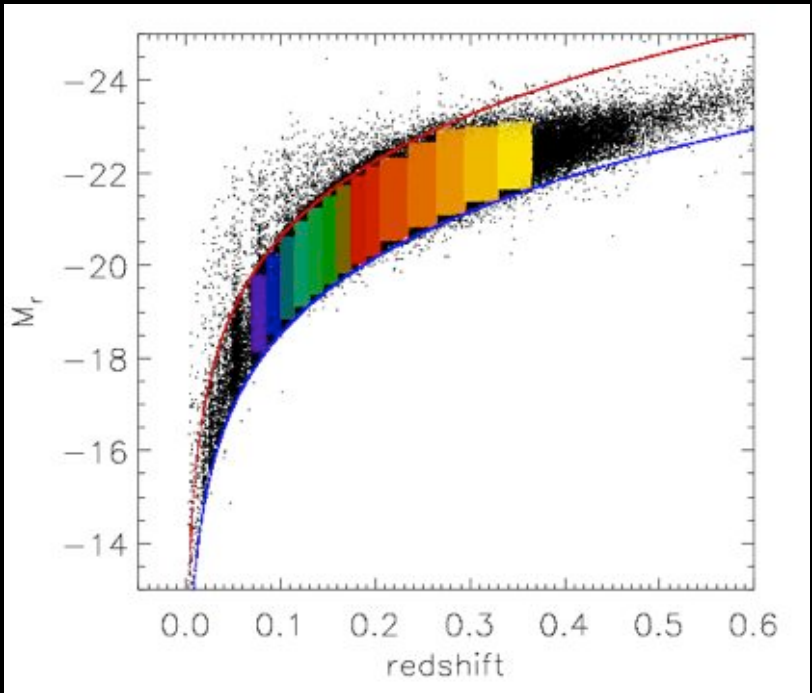
•We select Star-Forming galaxies excluding AGNs using the criteria given by Kauffmann et al. (2003) in BPT diagram [OIII] λ5007/Hβ vs. [N II] λ6583/Hα



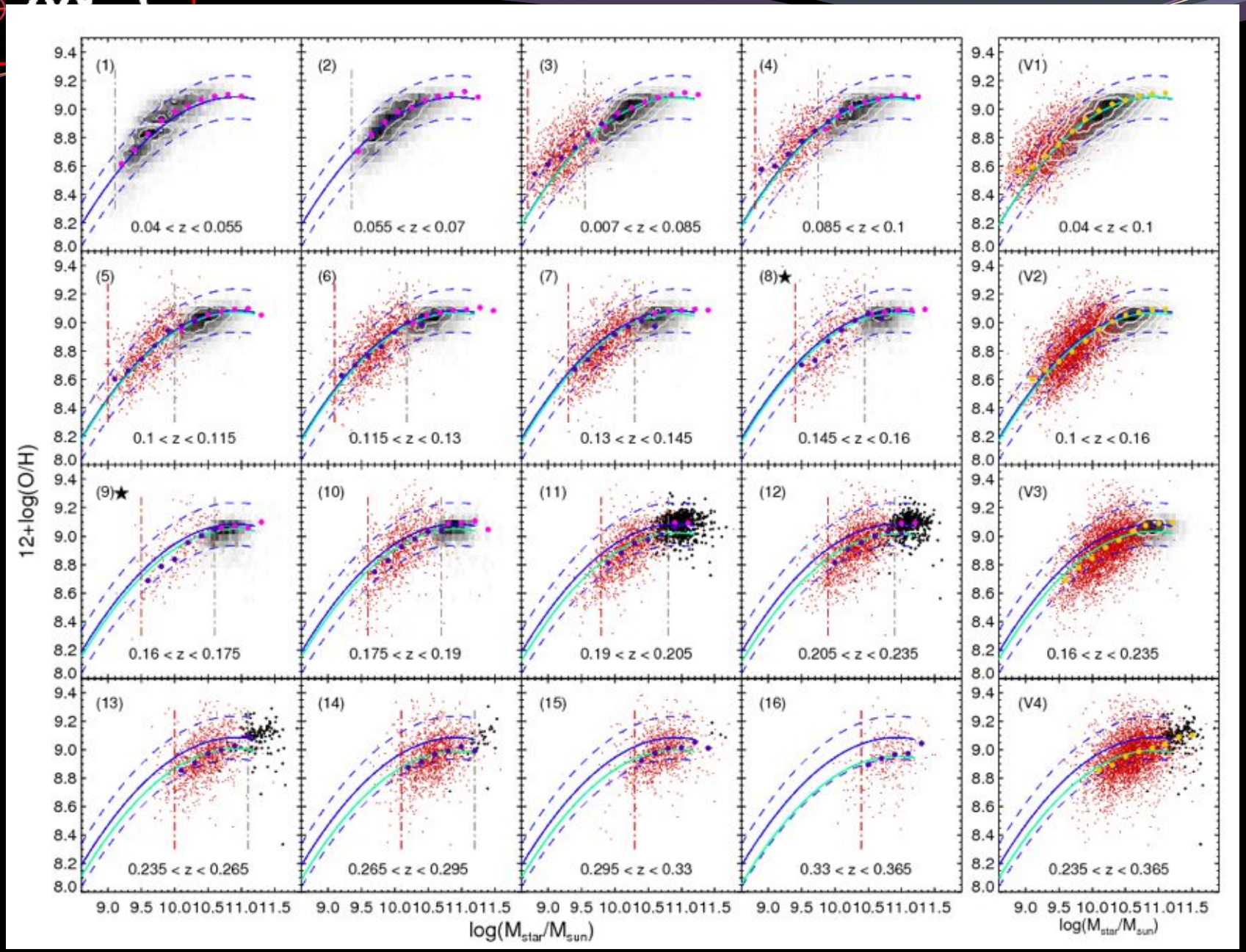
SDSS


−24
−22
−20
−18
−16
−14
$M_r$
0.0
0.1
0.2
0.3
0.4
0.5
0.6
redshift

GAMA

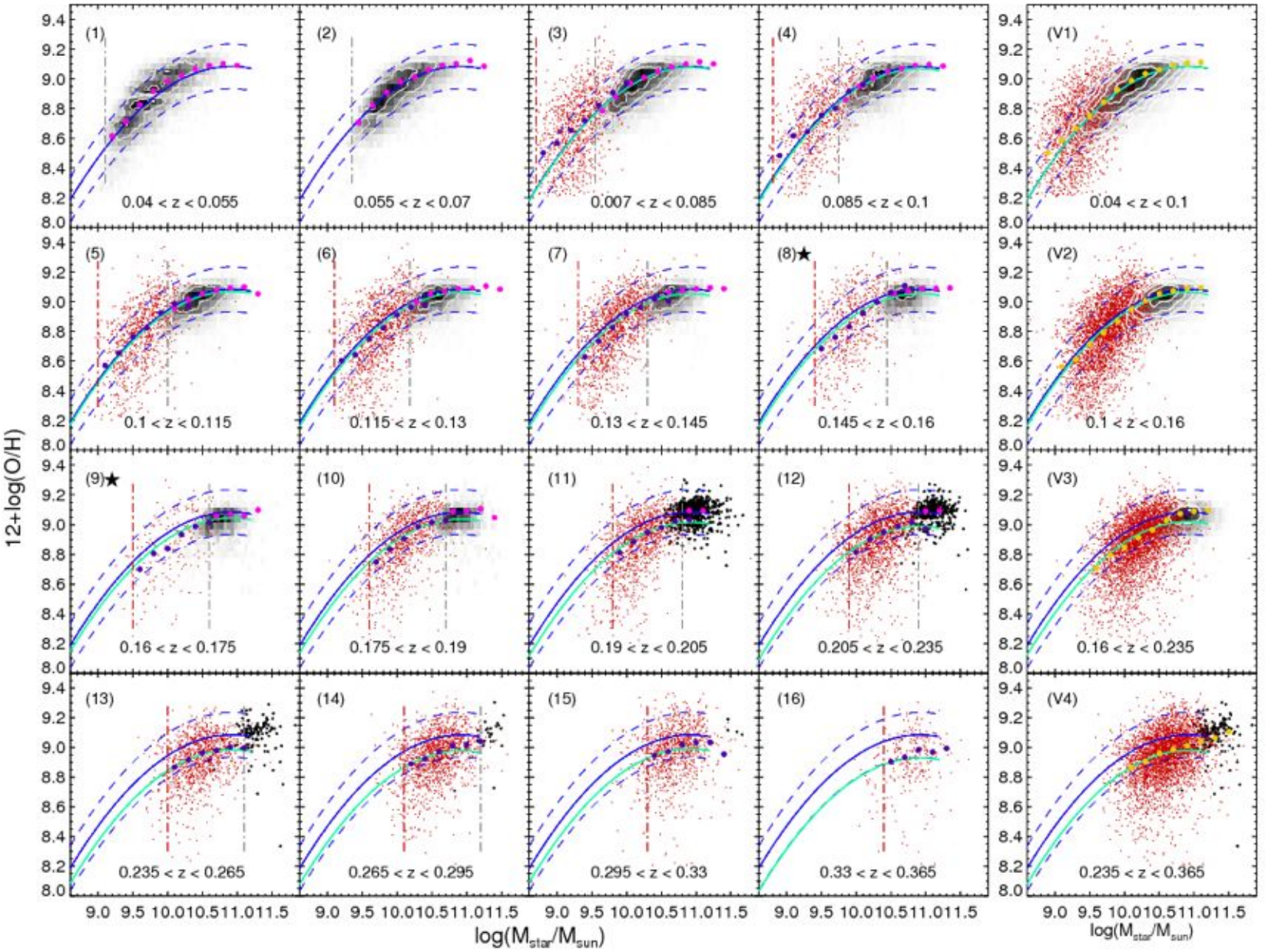

−24
−22
−20
−18
−16
−14
$M_r$
0.0
0.1
0.2
0.3
0.4
0.5
0.6
redshift

# M-Z relation



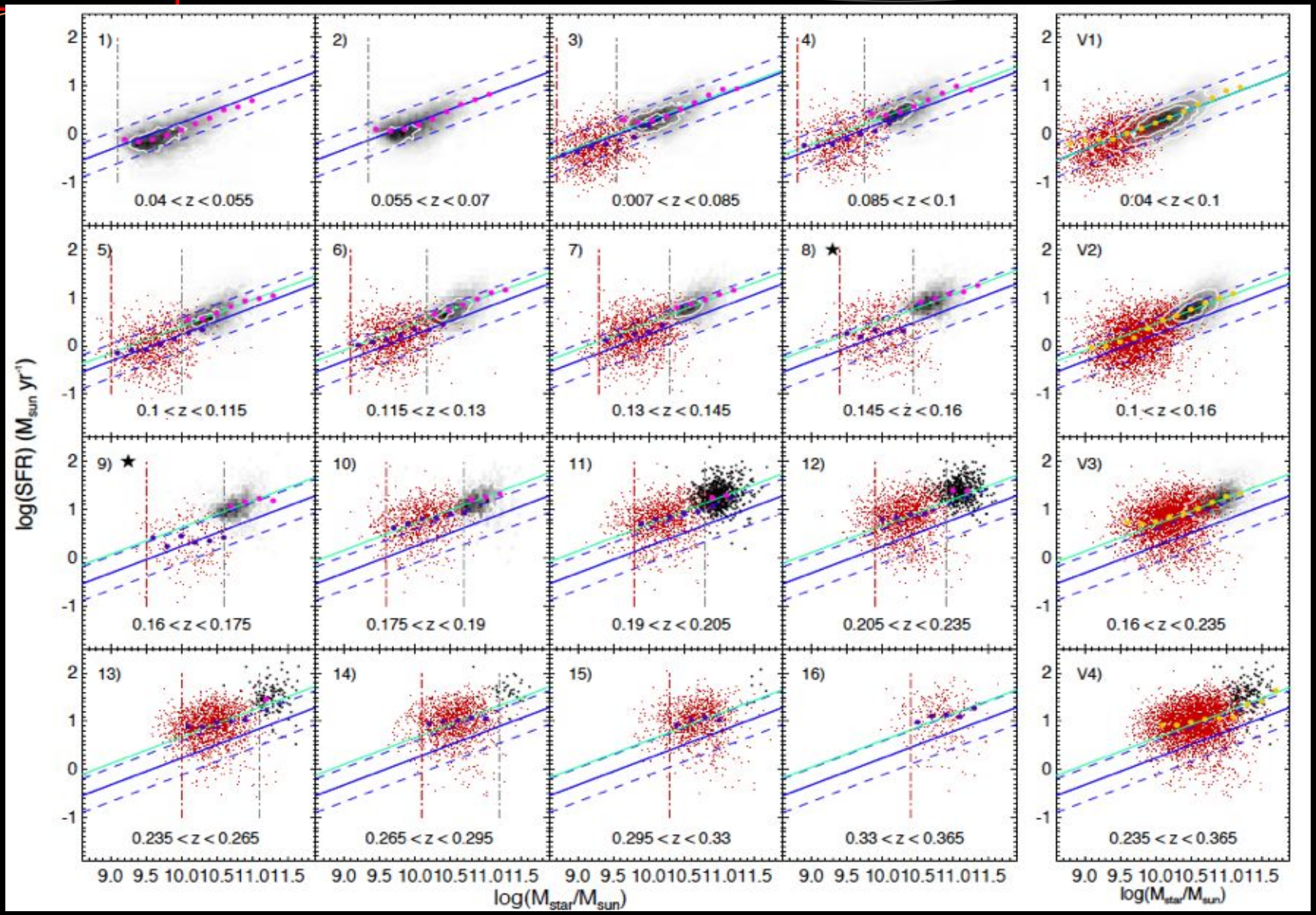

O3N2, Pettini & Pagel

# M-Z relation



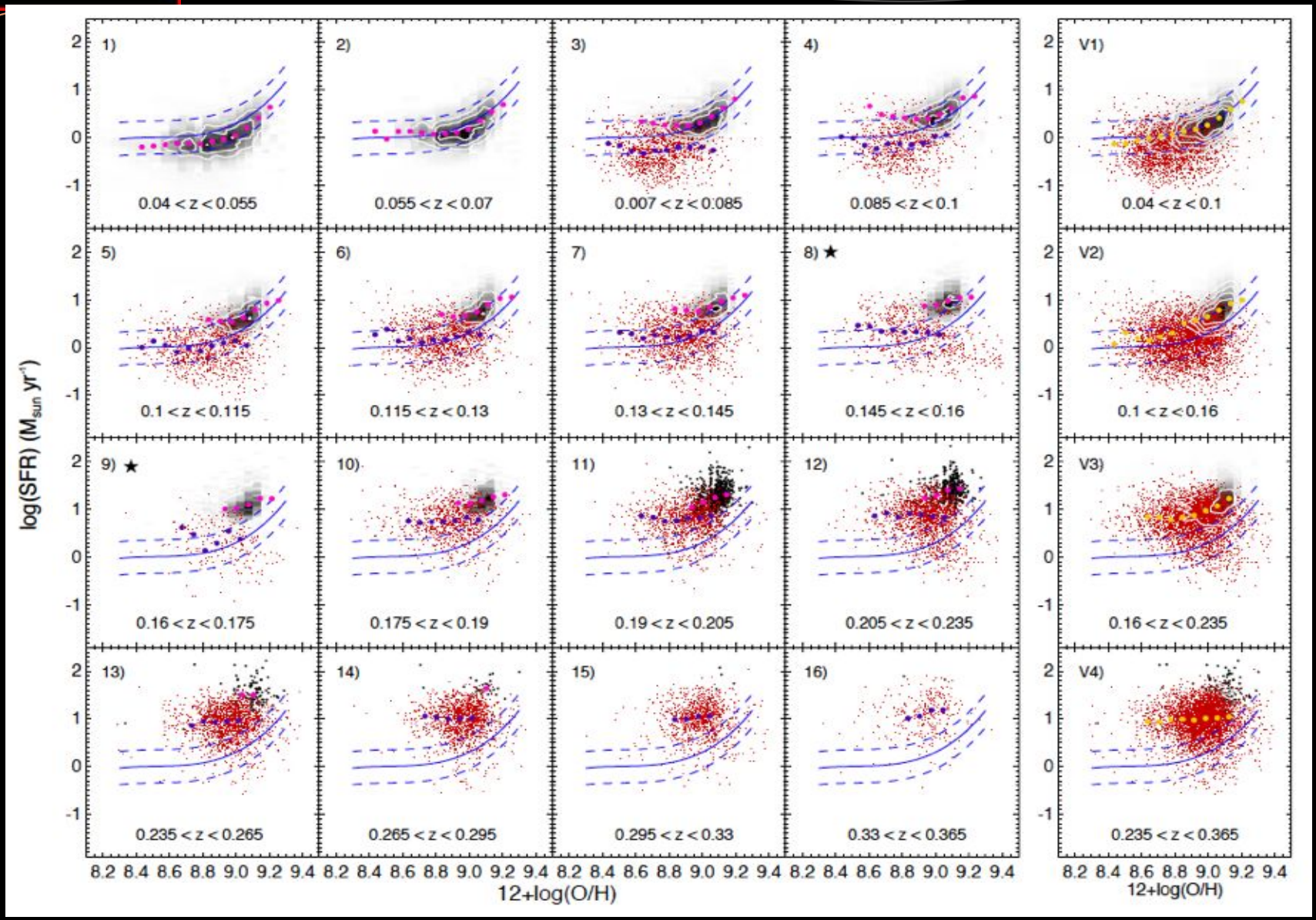

[NII]/[OII], Kewley & Dopia 2002

# M-SFR relation



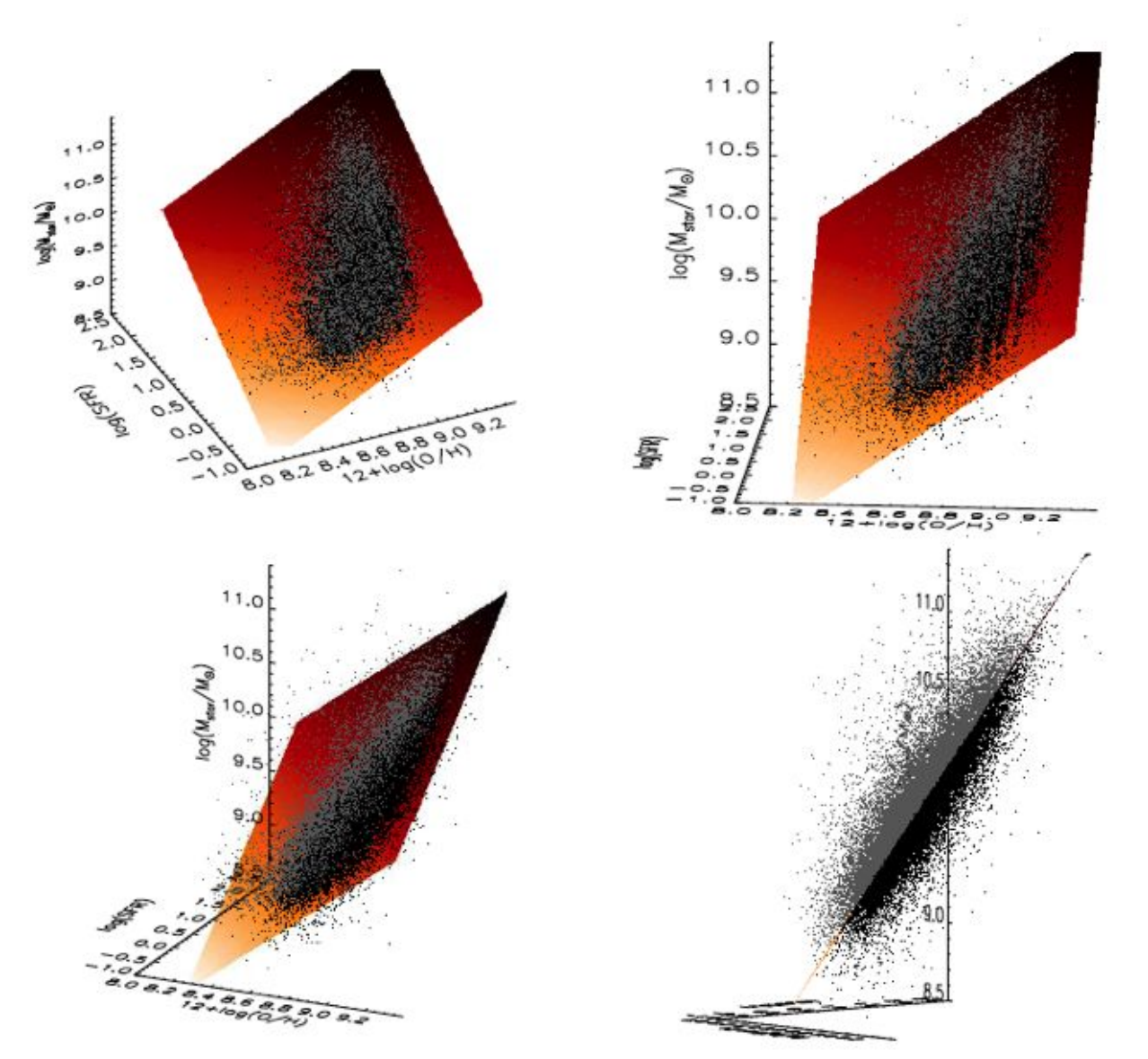

Lara-López et al. (2012, in progress)

# Z-SFR relation




Lara-López et al. (2012, in progress)

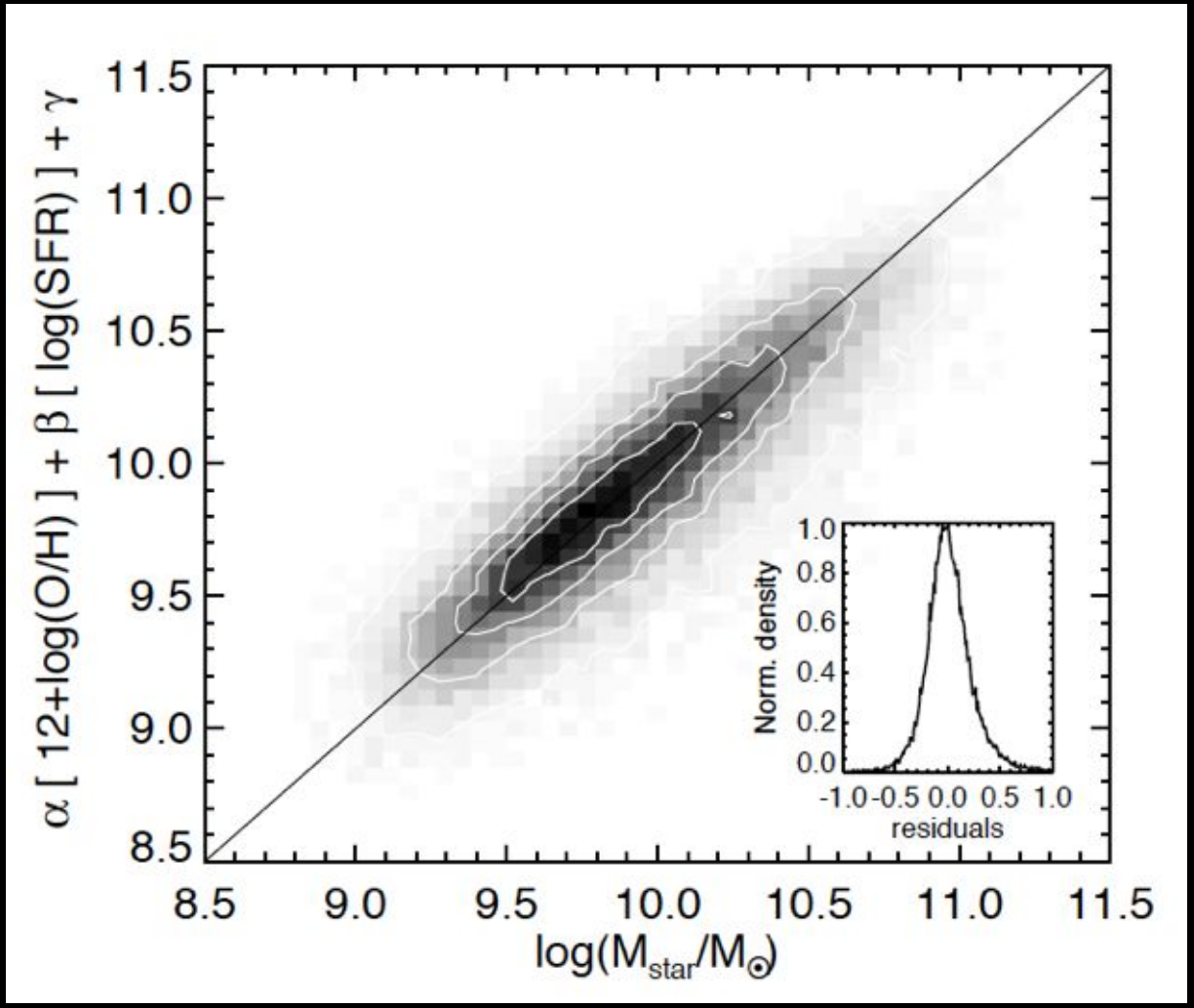
# A FP for GAMA and SDSS




Lara-López et al. (2012, in progress)

# A FP for GAMA and SDSS

α=1.376
β=0.6073
Γ= - 2.549



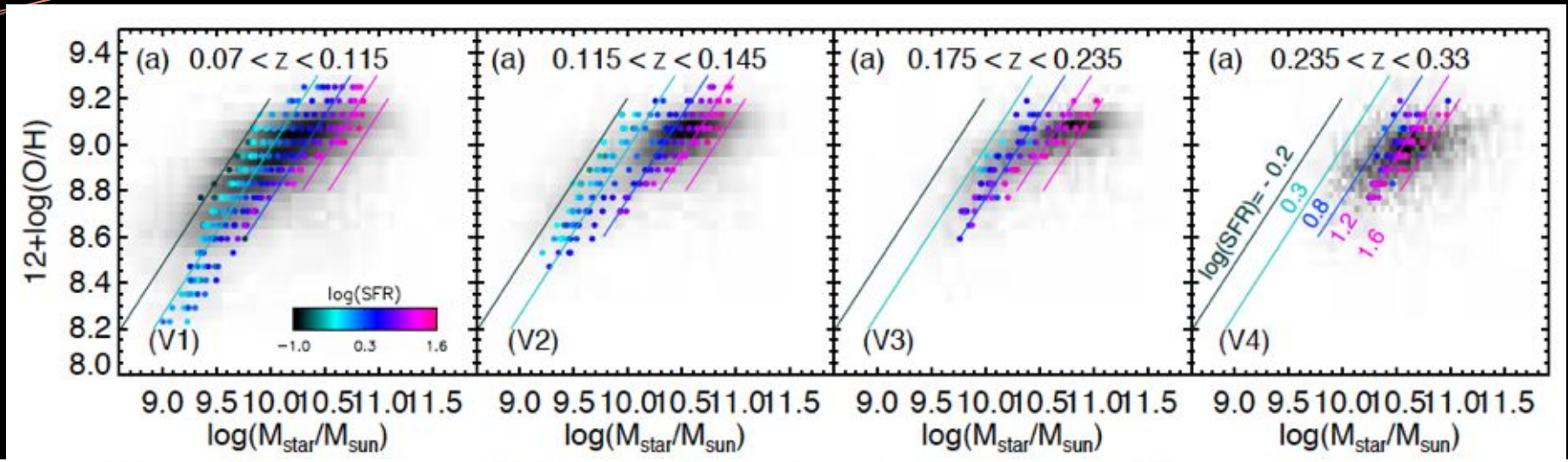

σ=0.2 dex

$$\log(M_\star/M_\odot) = \alpha\,[12 + \log(\mathrm{O/H})] + \beta\,[\log(\mathrm{SFR})] + \gamma$$

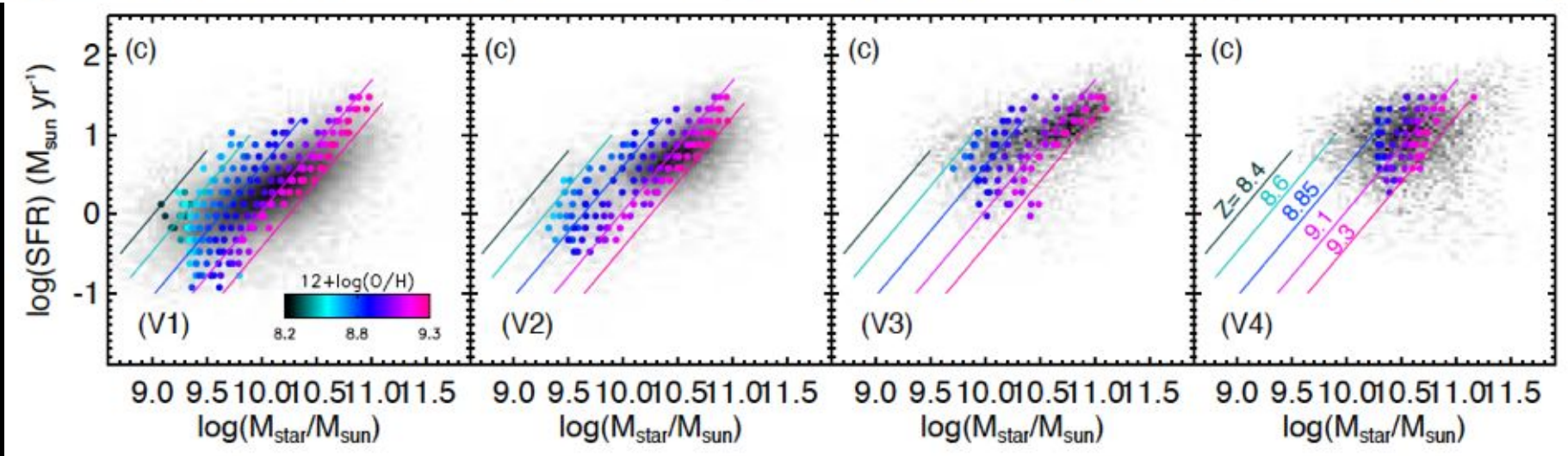
Lara-López et al. (2012, in progress)

# Show 3D plot

# Projections of the FP

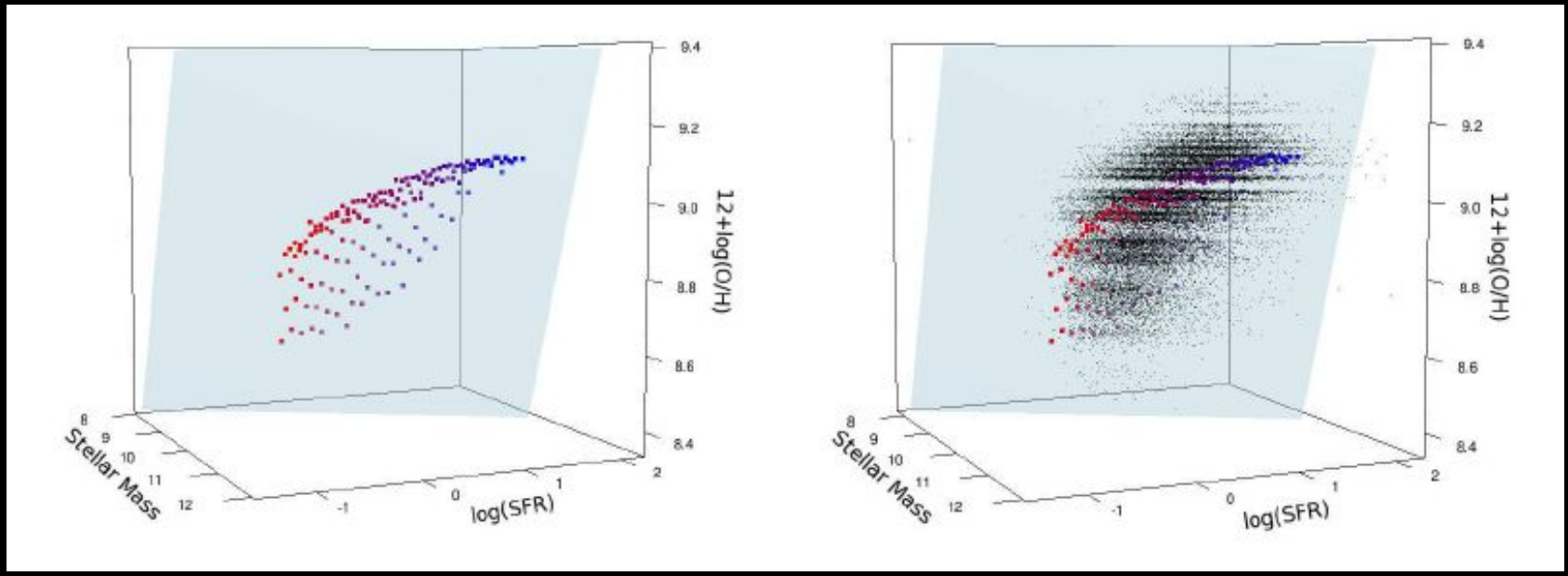



$$\log(M_\star/M_\odot) = \alpha\,[12 + \log(\mathrm{O/H})] + \beta\,[\log(\mathrm{SFR})] + \gamma$$




Lara-López et al. (2012, in progress)

# PCA & binning data




Lara-López, López-Sánchez & Hopkins (2012, ApJ in revision)

-PCA is a mathematical procedure that converts a set of observations of possible correlated variables into a set of uncorrelated variables called principal components.
-Goal of PCA: reveal hidden structure & reduce the dimensionality of the data

-PCA shows that the 98% of the variance can be explained by a Plane

-Z vs. SFR shows the highest dispersion of the data, which means that this relation Is close to the face-on view of the plane

# Thank you!