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

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A fundamental plane for field galaxies

Z-SFR

Metallicity

SFR

M-Z

M-SFR

Stellar Mass

Tremonti et al. (2004)

Lara-López et al. (2010)

López-Sánchez (2010)

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

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

\(\alpha=1.122\)
\(\beta=0.474\)
\(\gamma=-0.097\)

Lara-López et al. (2010)
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)
• We select Star-Forming galaxies excluding AGNs using the criteria given by Kauffmann et al. (2003) in BPT diagram [OIII] $\lambda 5007$/H$\beta$ vs. [N II] $\lambda 6583$/H$\alpha$
SDSS

GAMA
M-Z relation

O3N2, Pettini & Pagel
M-Z relation

[NII]/[OII], Kewley & Dopia 2002
Lara-López et al. (2012, in progress)
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

\[
\log(M_*/M_\odot) = \alpha \left[ 12 + \log(O/H) \right] + \beta \left[ \log(\text{SFR}) \right] + \gamma
\]

Lara-López et al. (2012, in progress)

\( \alpha = 1.376 \)
\( \beta = 0.6073 \)
\( \Gamma = -2.549 \)

\( \sigma = 0.2 \text{ dex} \)
Show 3D plot
Projections of the FP

\[ \log(M_\star/J_{\odot}) = \alpha \left[ 12 + \log(O/H) \right] + \beta \left[ \log(SFR) \right] + \gamma \]

Lara-López et al. (2012, in progress)

-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!