LEGA-C + CANDELS

Constraining the star formation histories of galaxies

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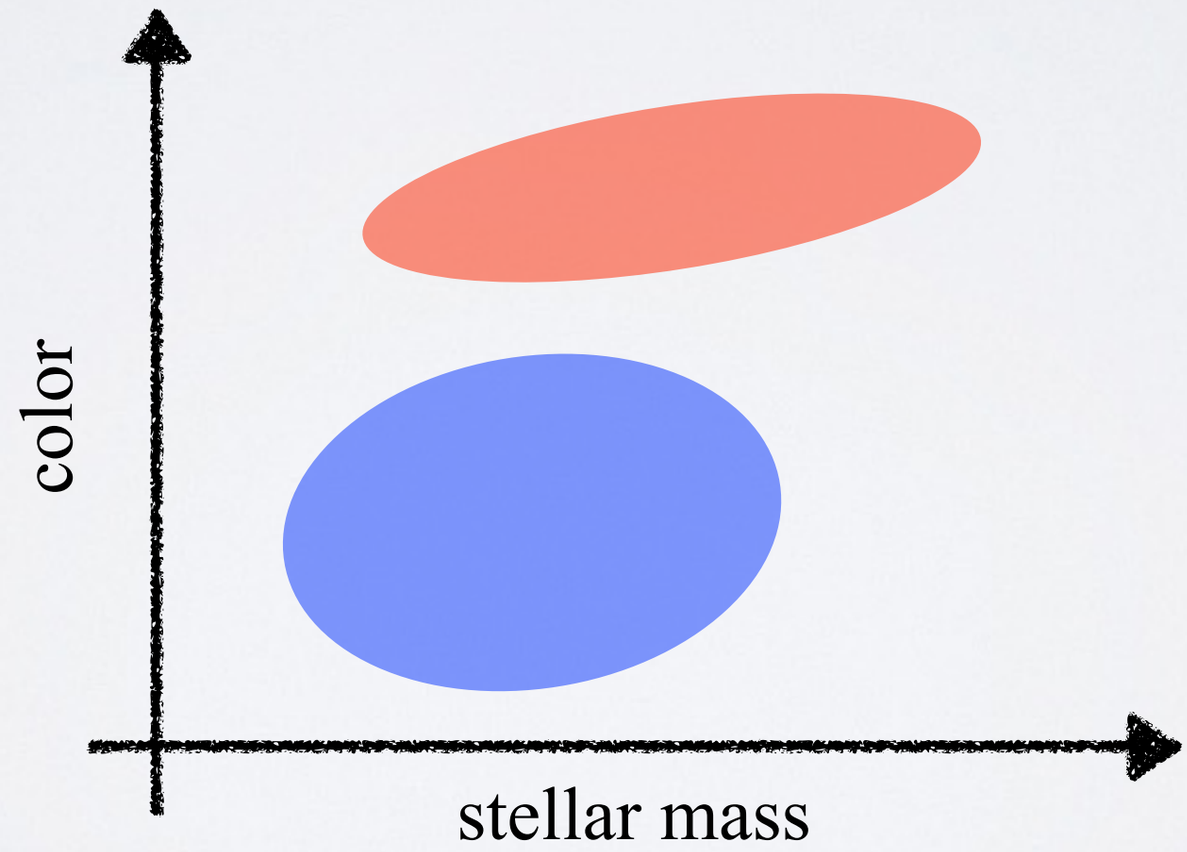
Guillermo Barro, Eric Bell, Stephane Charlot, Darren Croton, Avishai Dekel, Adriano Fontana, Eric Gawiser, Mauro Giavalisco, Norman Grogin, Brad Holden, Anton Koekemoer, David Koo, Seong-Kook Lee, Joel Primack, Marc Rafelski, Brett Salmon, Raymond Simons, Rachel Somerville, Ben Weiner

IAP Colloquium, Cosmic dawn of galaxy formation, 23.6.2016

The evolution of galaxies

?

Bimodality in galaxy properties



Strateva et al. 2001, Hogg et al. 2003, Balogh et al. 2004, Baldry et al. 2004, Bell et al. 2004, Weiner et al. 2005

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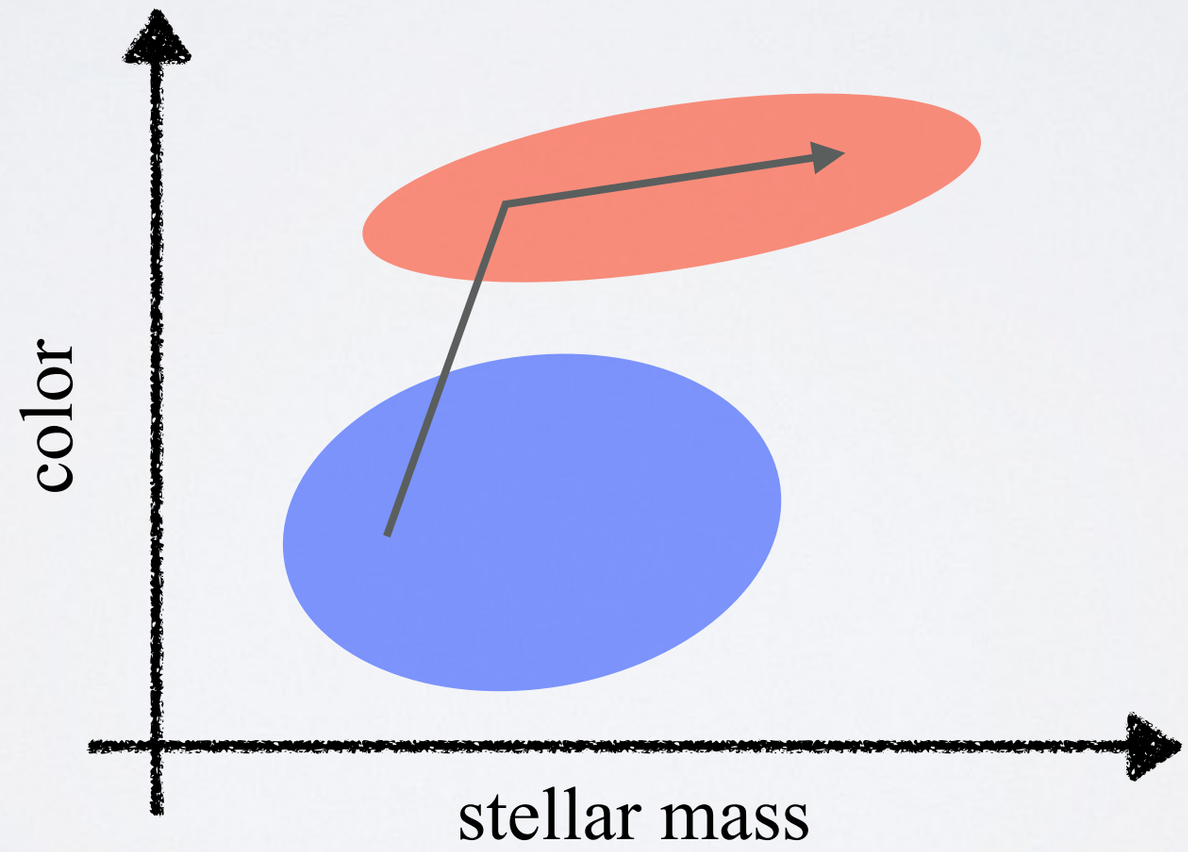

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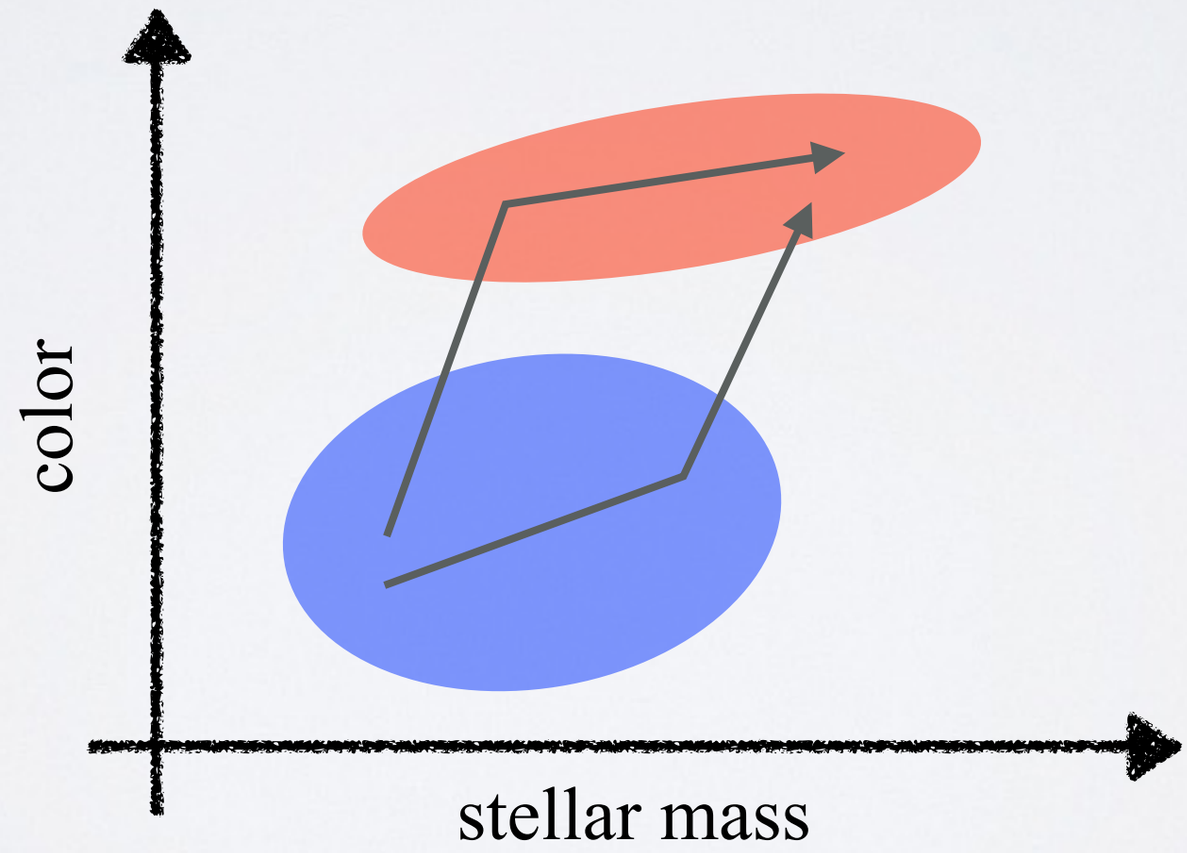

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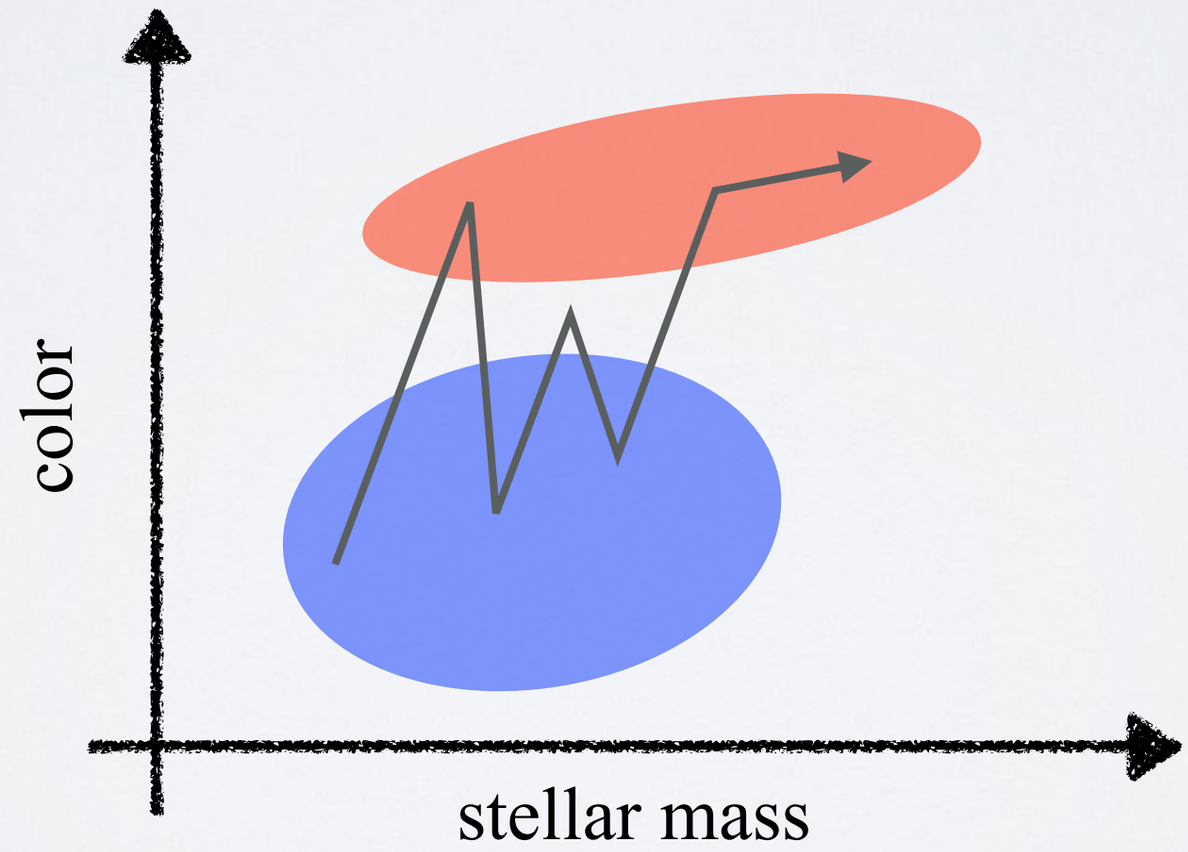

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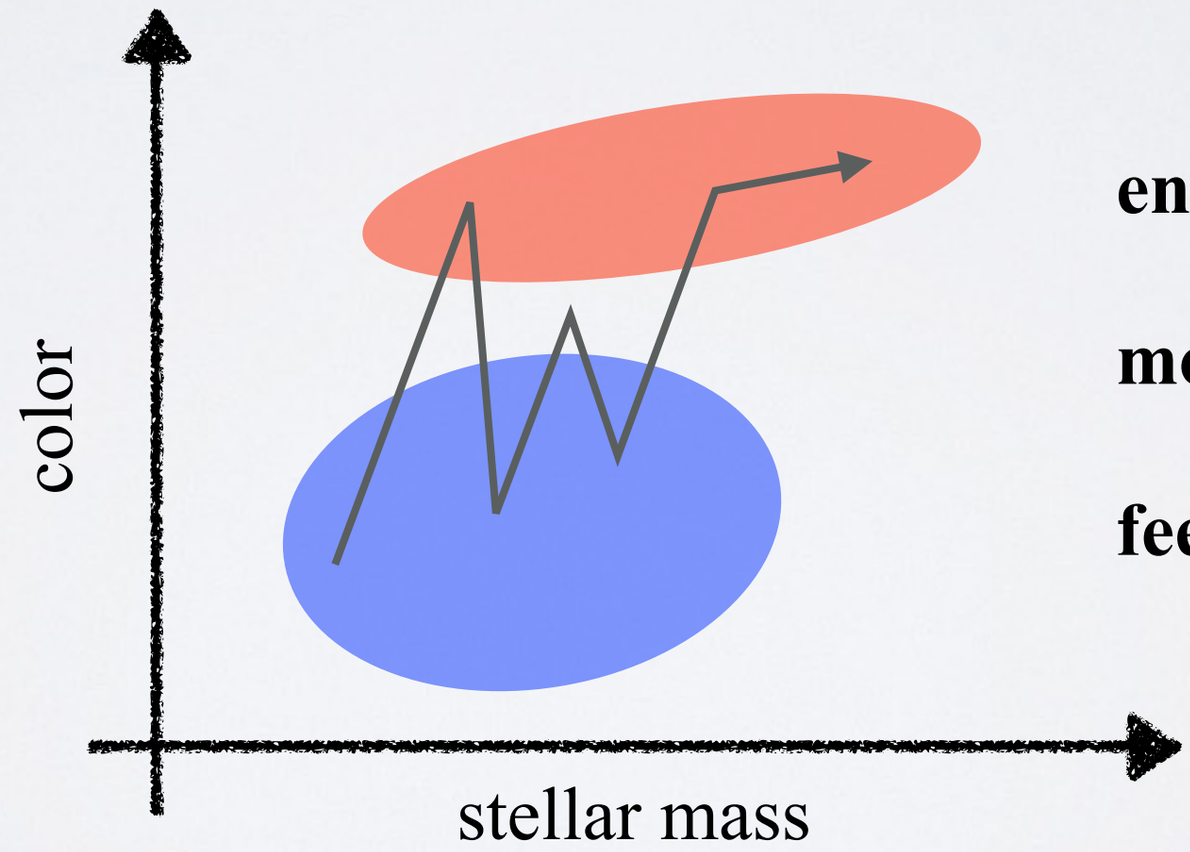

environment

morphology

feedback

?

Peng et al. 2010, Graves et al. 2009, 2010, Fang et al. 2013
Zolotov et al. 2015, Tacchella et al. 2015, Barro et al. 2015

The evolution of galaxies

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Measuring ages and metallicities from spectra

Worthy et al. 1992, Faber et al. 1995, Trager et al. 2000, Schiavon et al. 2007, Choi et al, 2014, Gallazzi et al. 2014

Connecting populations of galaxies via abundance matching

van Dokkum et al. 2013, Patel et al. 2013, Papovich et al. 2015

Measuring SFHs form the fossil record in the data

Panter et al. 2003, 2007, McDermid et al. 2015, Pacifici et al. 2016

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Models of galaxy spectral energy distributions

Build a library of model spectra to best reproduce the observations

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star formation and chemical enrichment histories

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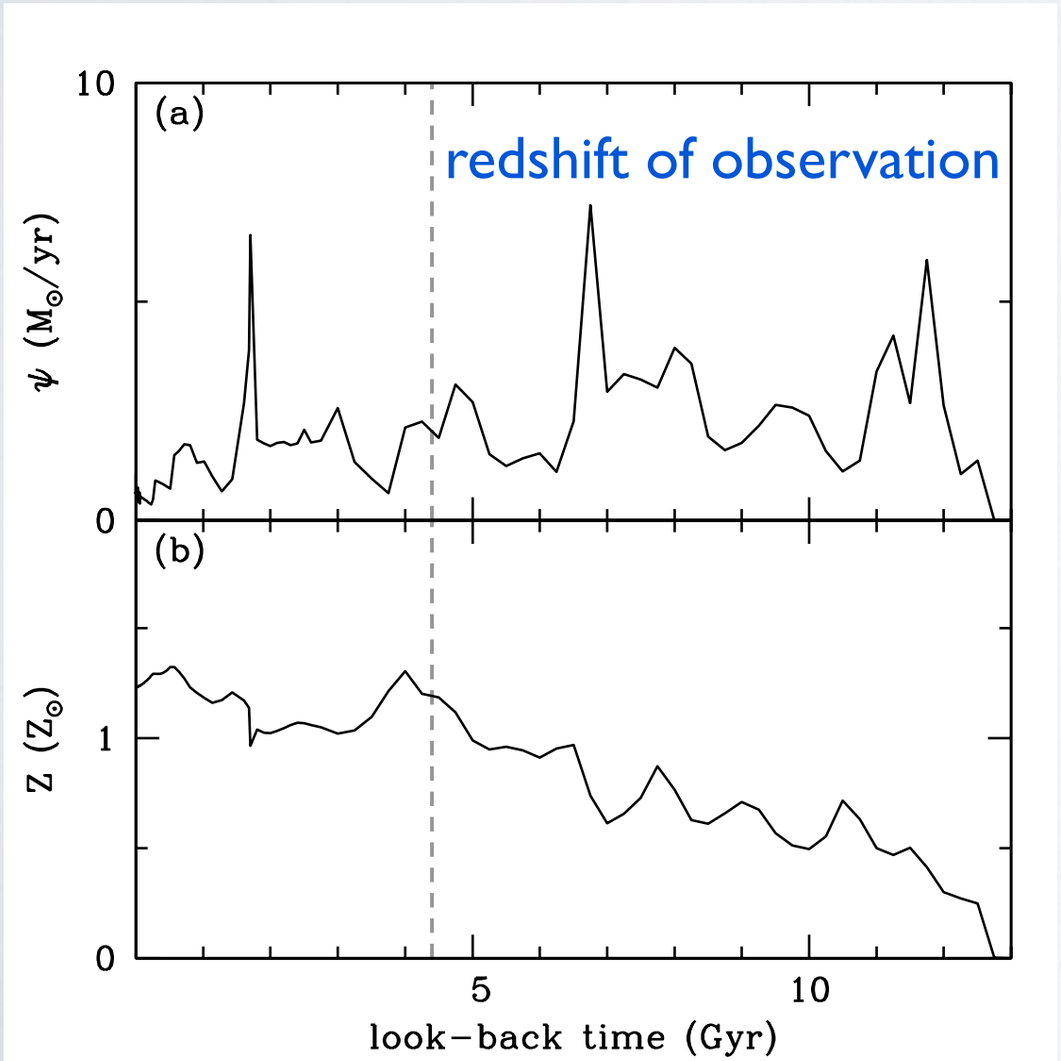

semi-analytic post-processing
of the Millennium Simulation

Springel et al. (2005), Croton et al. (2006)
De Lucia & Blaizot (2007), Hirschmann et al. (2015)

Pacifici et al. (2012)

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effect of the dust

use models as priors to interpret the observations

(e.g. BEAGLE)

Application to different datasets

- DEEP 2 photometry and spectroscopy at z~1
- 3D-HST photometry and grism spectroscopy
- GALEX + SDSS + WISE photometry at z~0
- CANDELS photometry at 0.2<z<2.1
- LEGA-C spectroscopy + UltraVISTA/CANDELS photometry

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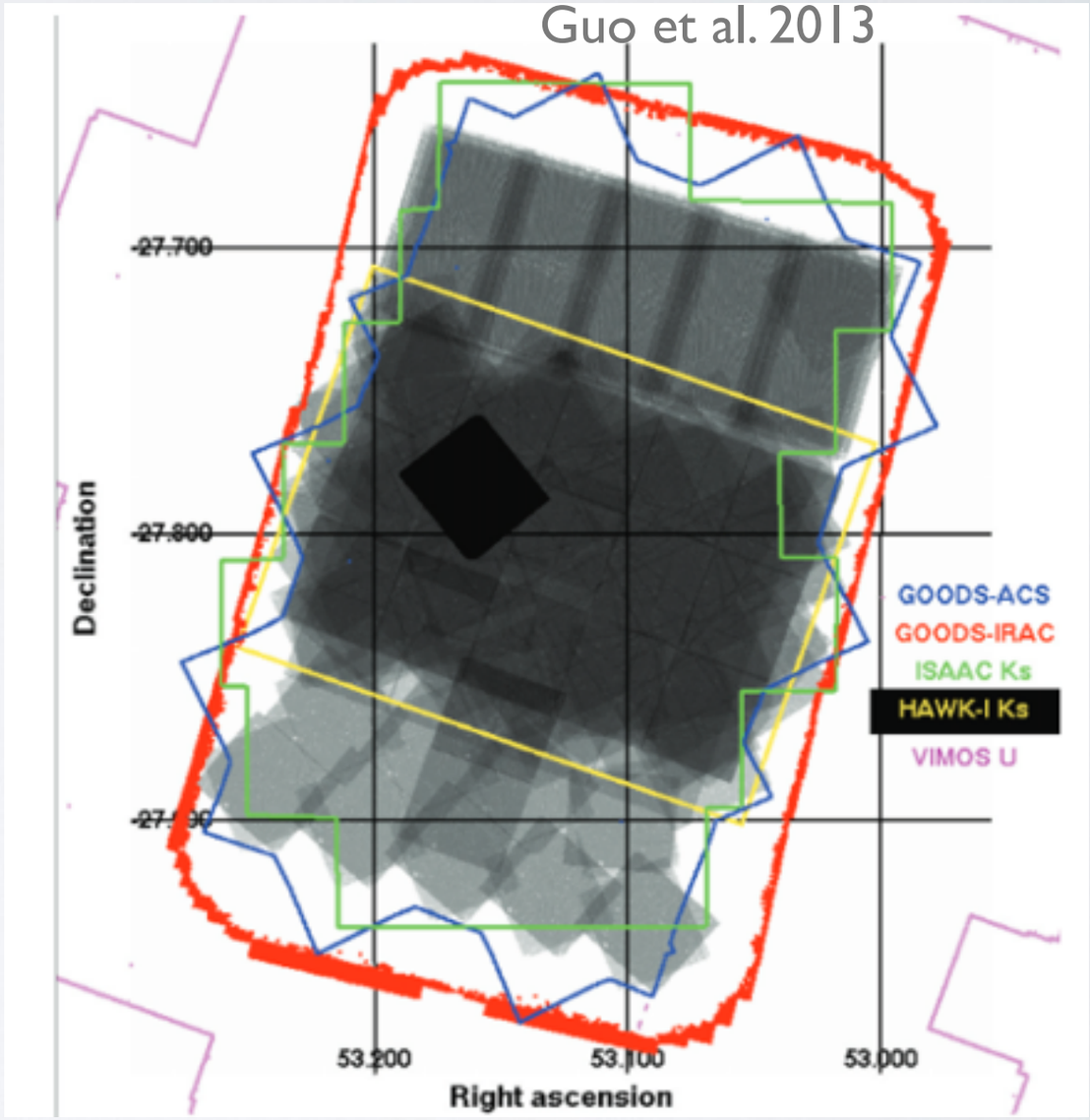
CANDELS sample

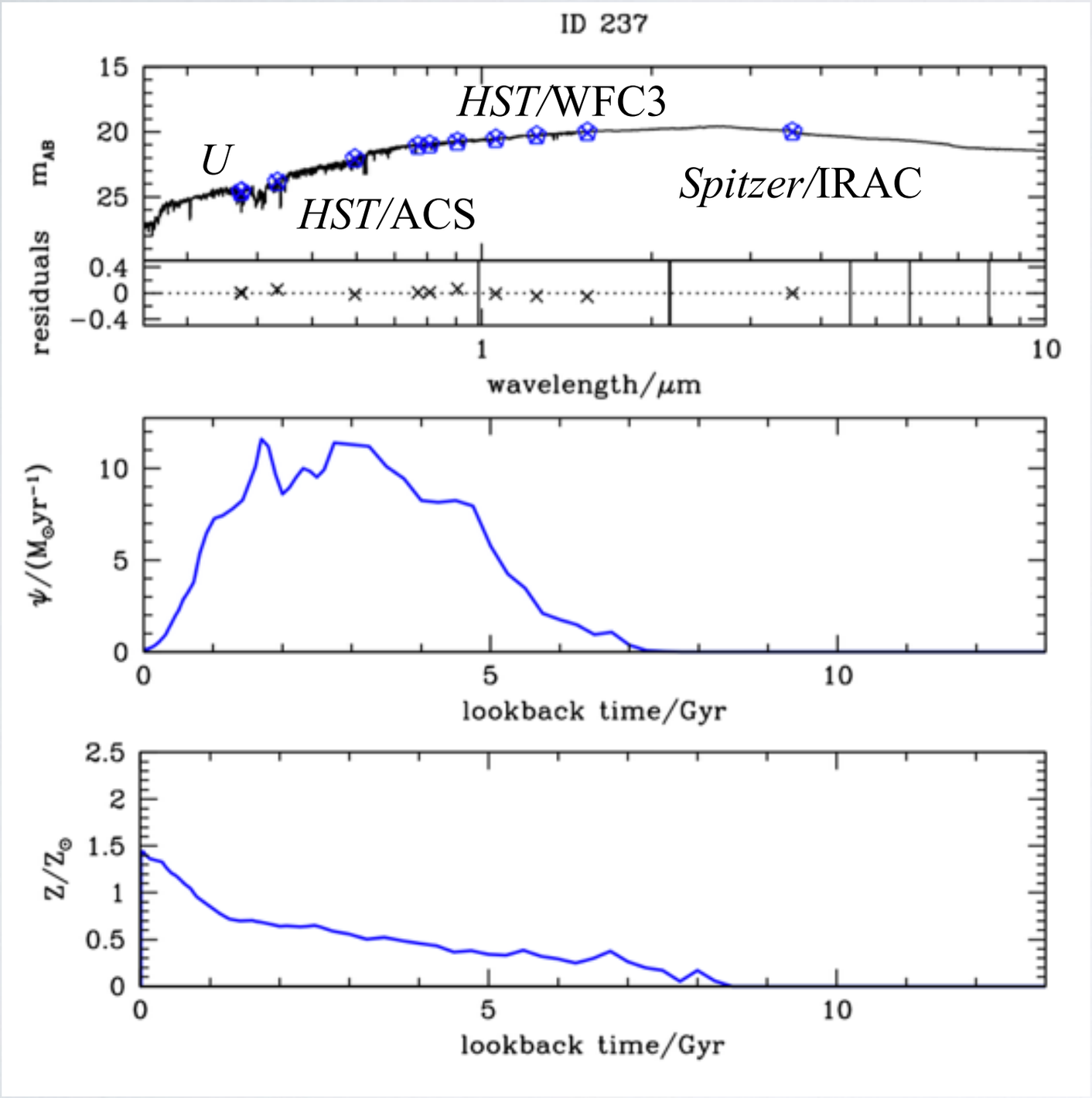
- CANDELS observations
  - 17 photometric bands sampling the rest-frame UV to NIR
- GOODS-South and GOODS-North
- $0.2<z<2.1$
- $H<26$ and stellar mass $\log(M/M_{\odot})>9$
- We select 6183 galaxies
- 861 are quiescent galaxies



GOODS-South
Guo et al. 2013

Pacifici, Kassin et al.

Fitting procedure - photometry



fit the SED, using our library of physically motivated models

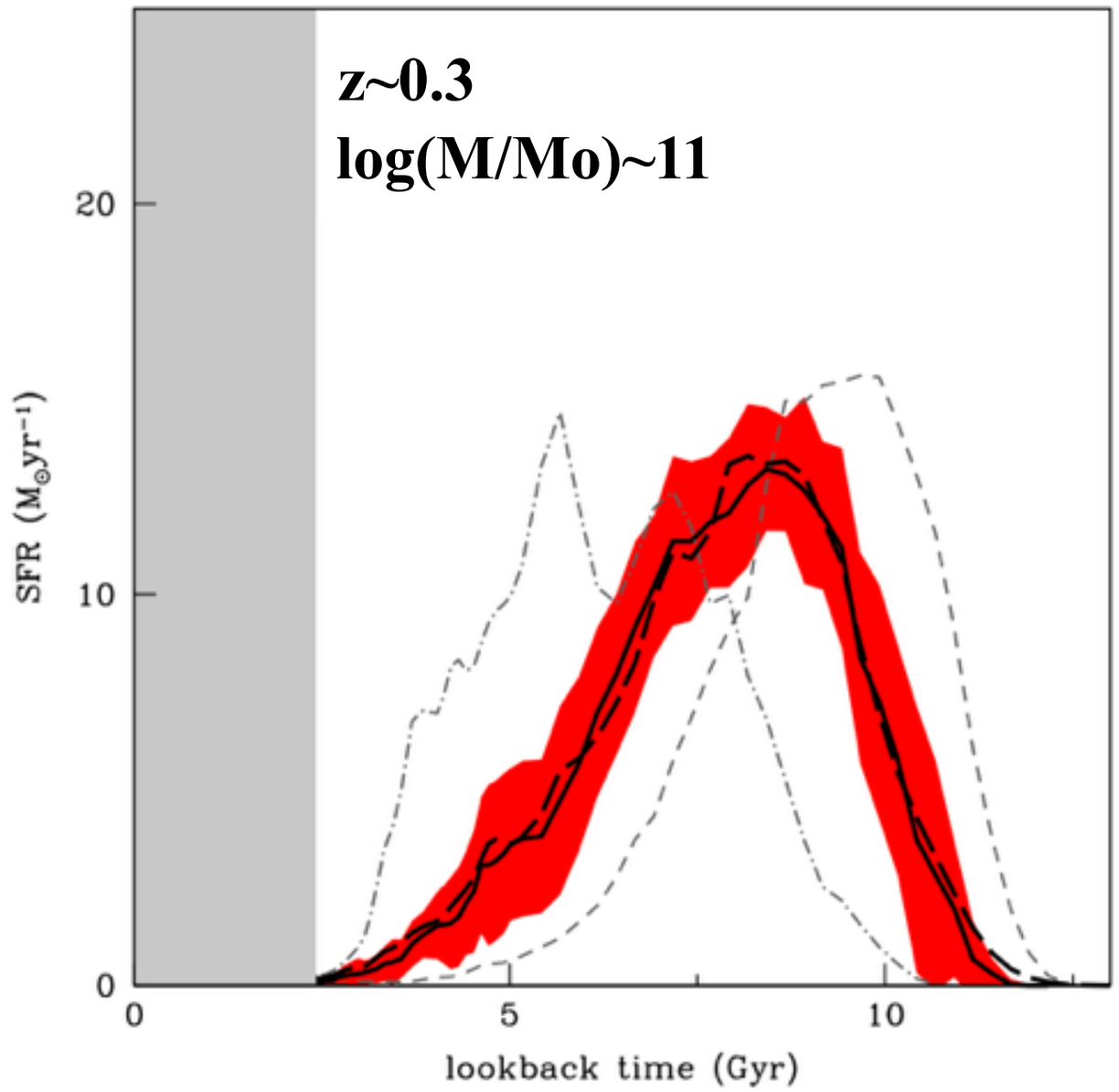
extract the best-estimate **star formation history** by averaging all the model SFHs weighted by their likelihoods

extract the best-estimate **metal enrichment history** by averaging all the model histories weighted by their likelihoods

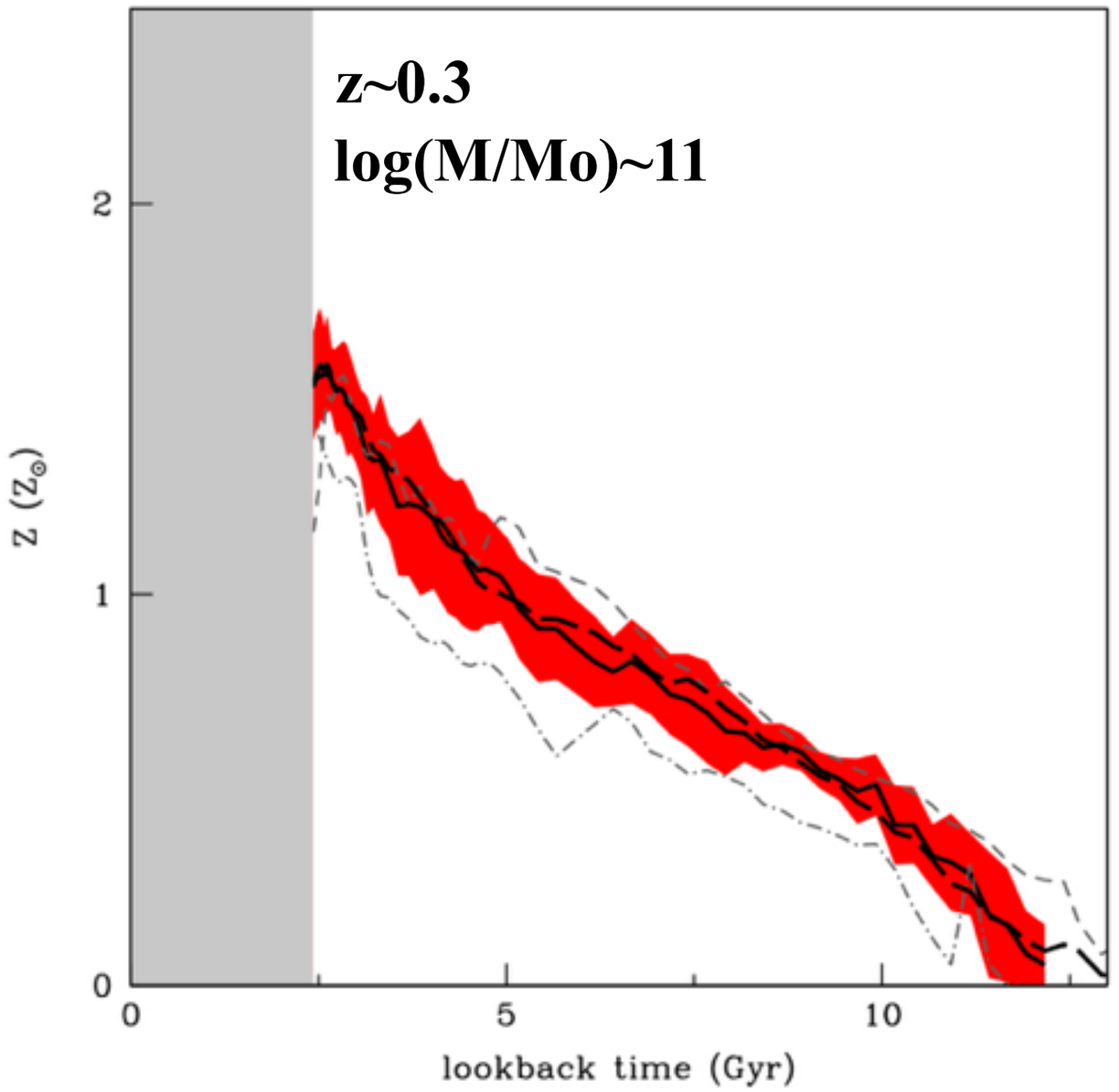
Pacifici, Kassin et al.

The star formation histories of galaxies

median star formation history



median metal enrichment history



Pacifici, Kassin et al.

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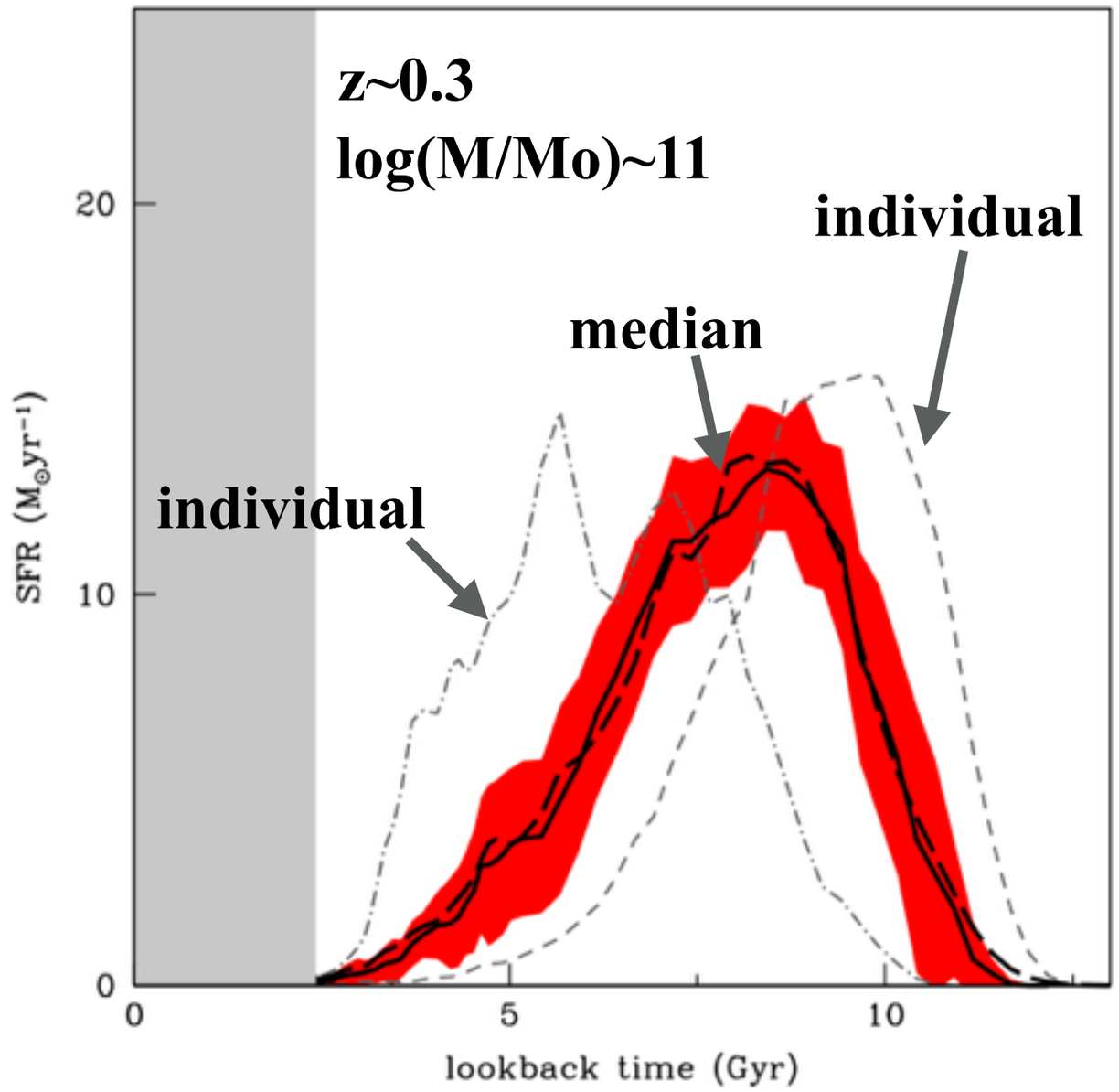
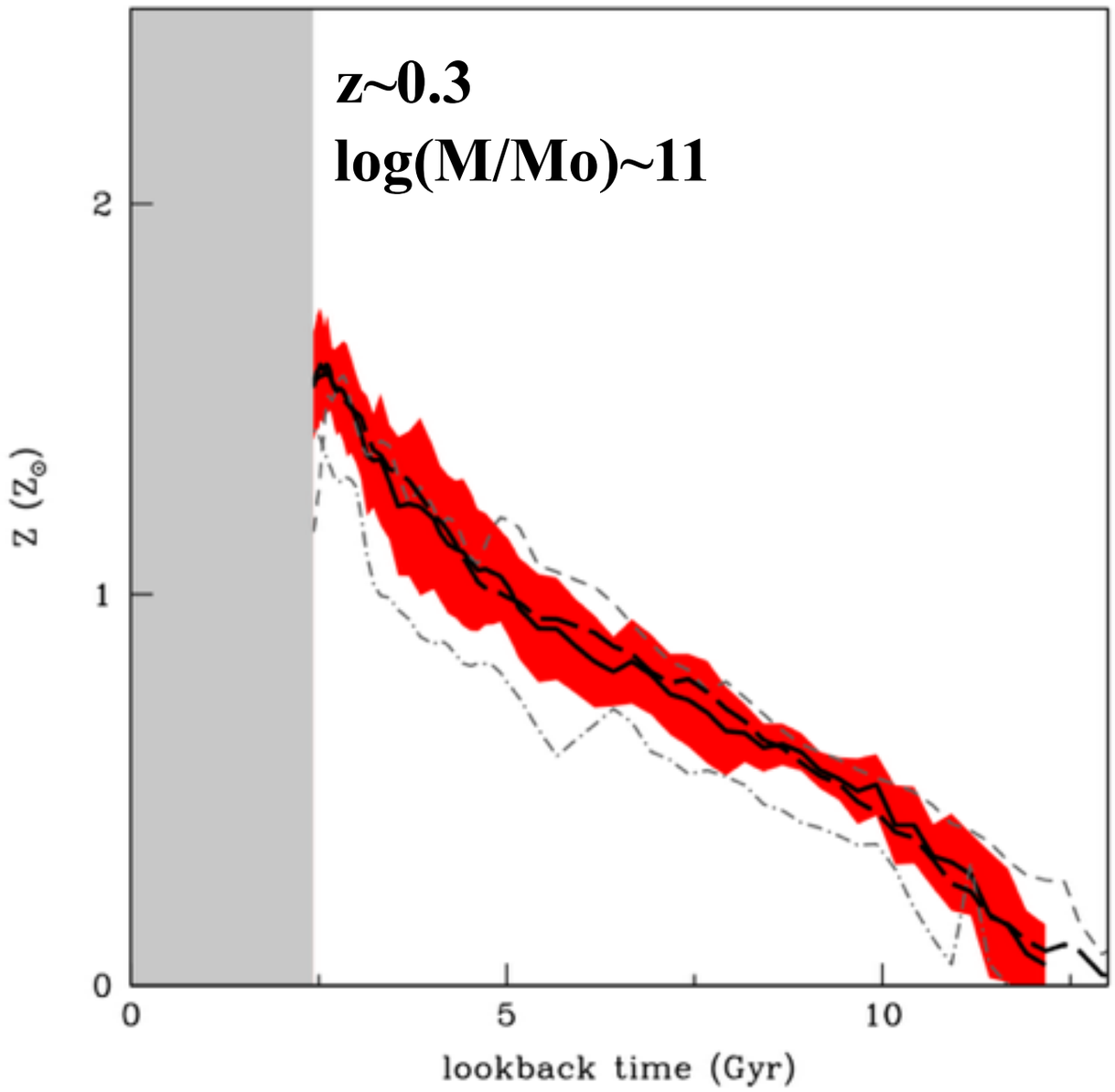


median metal enrichment history



Pacifici, Kassin et al.

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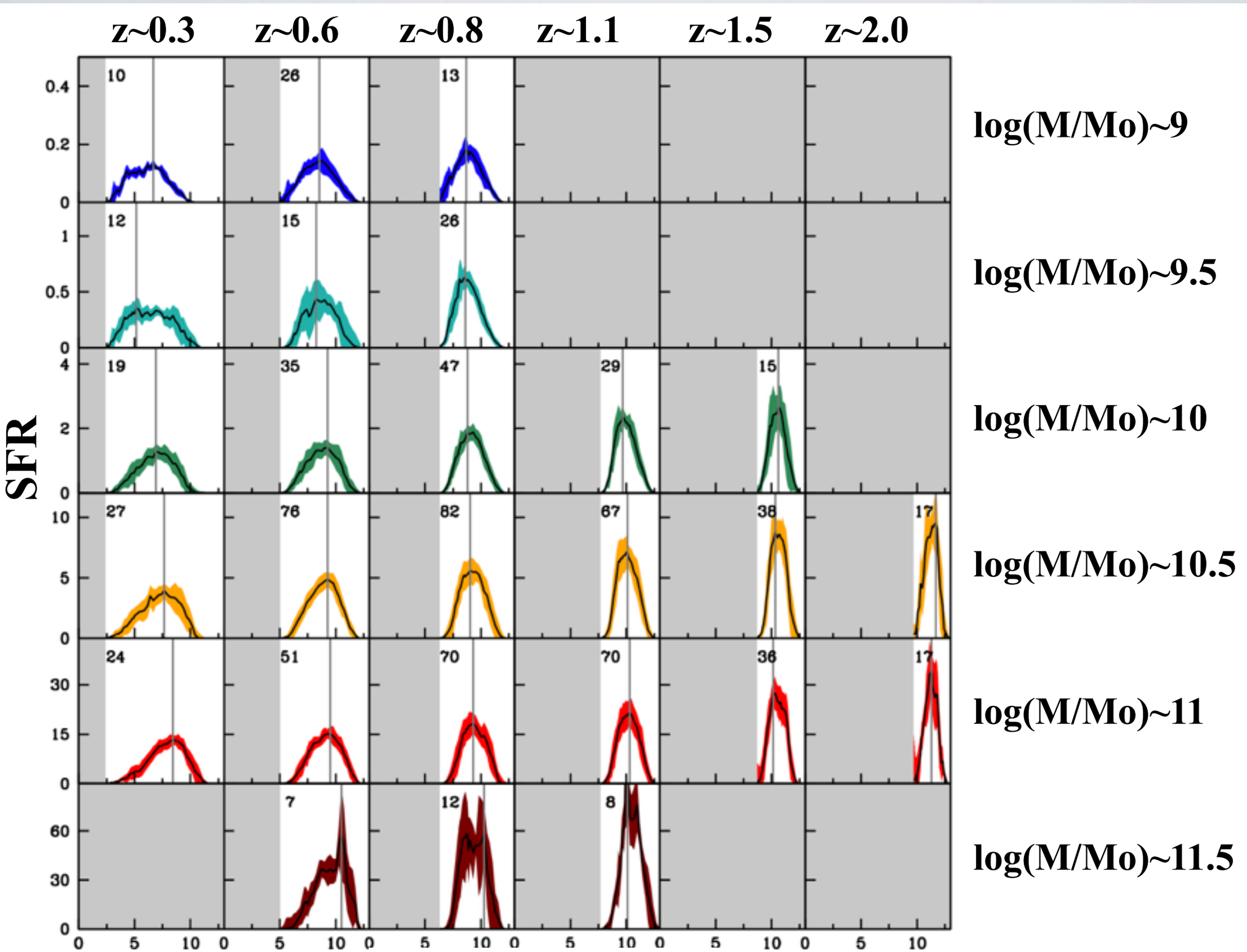

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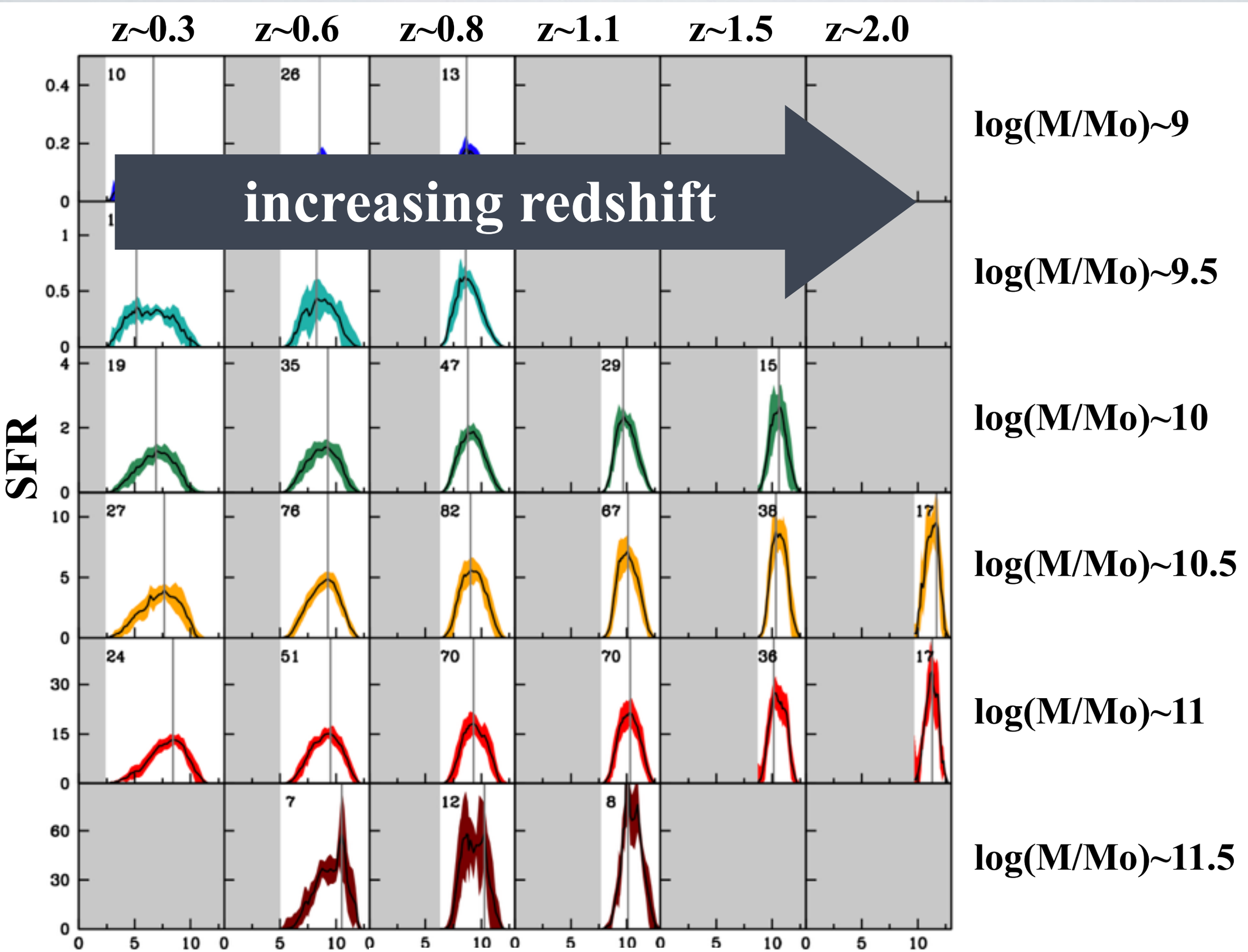

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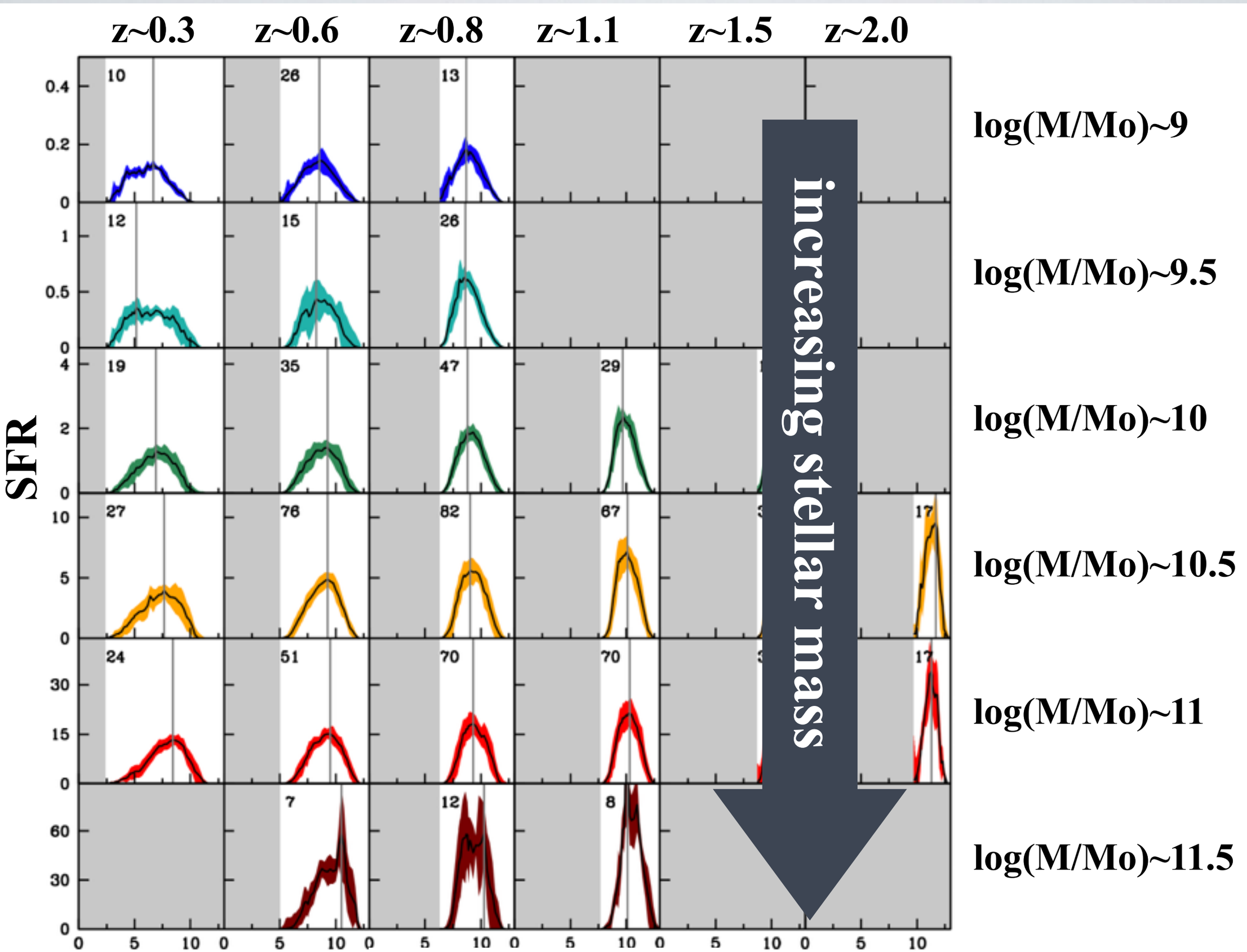

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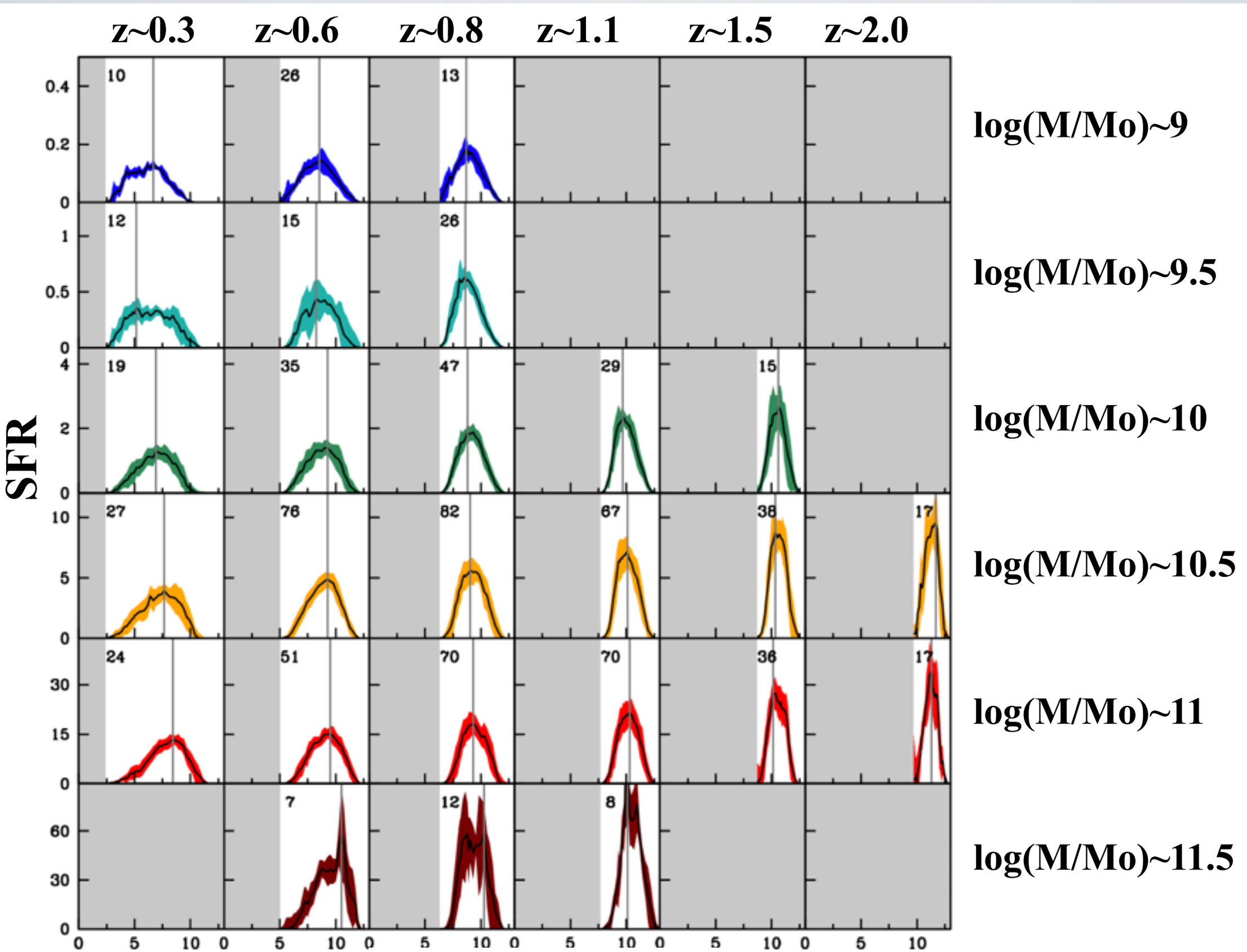

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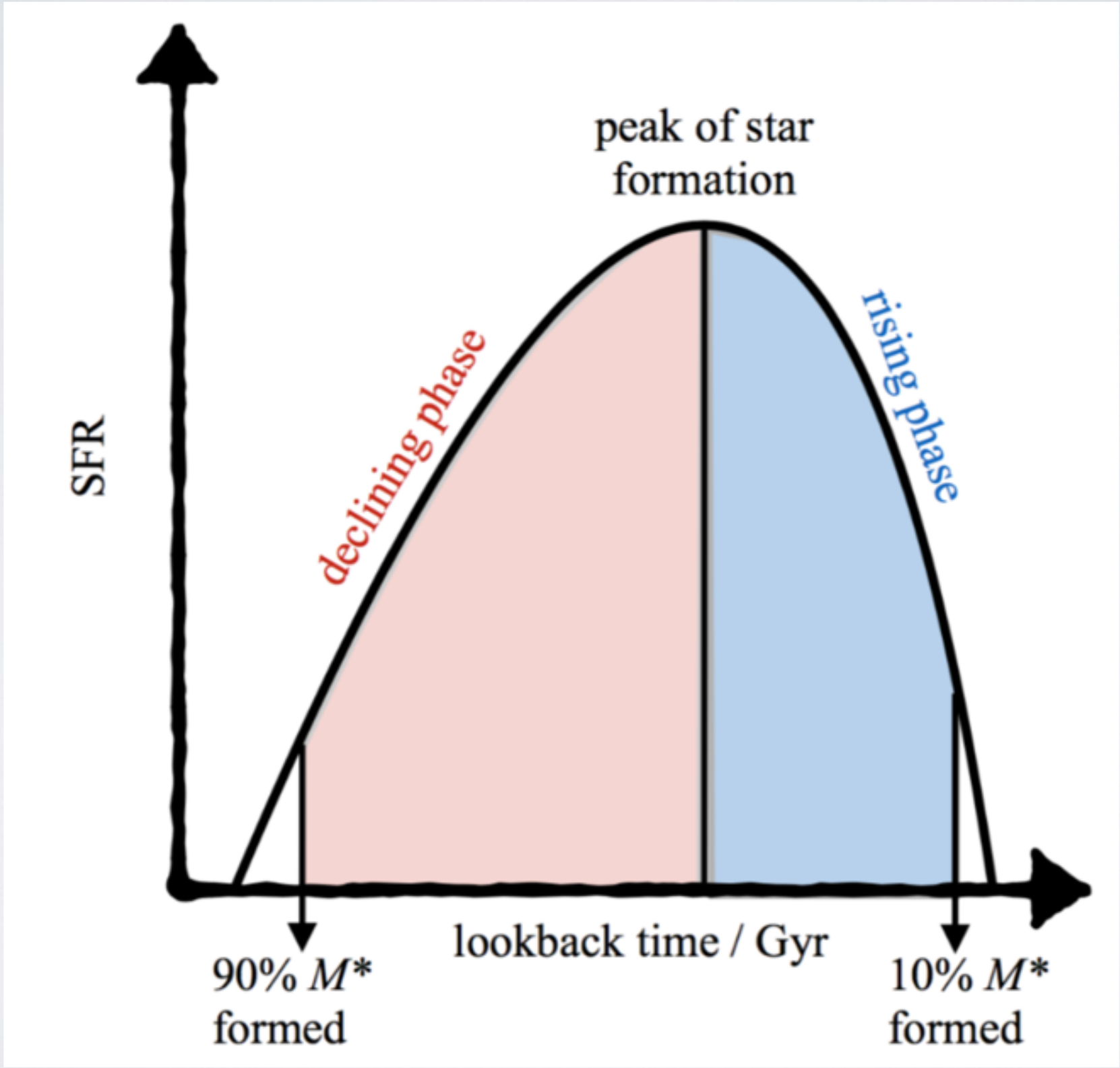

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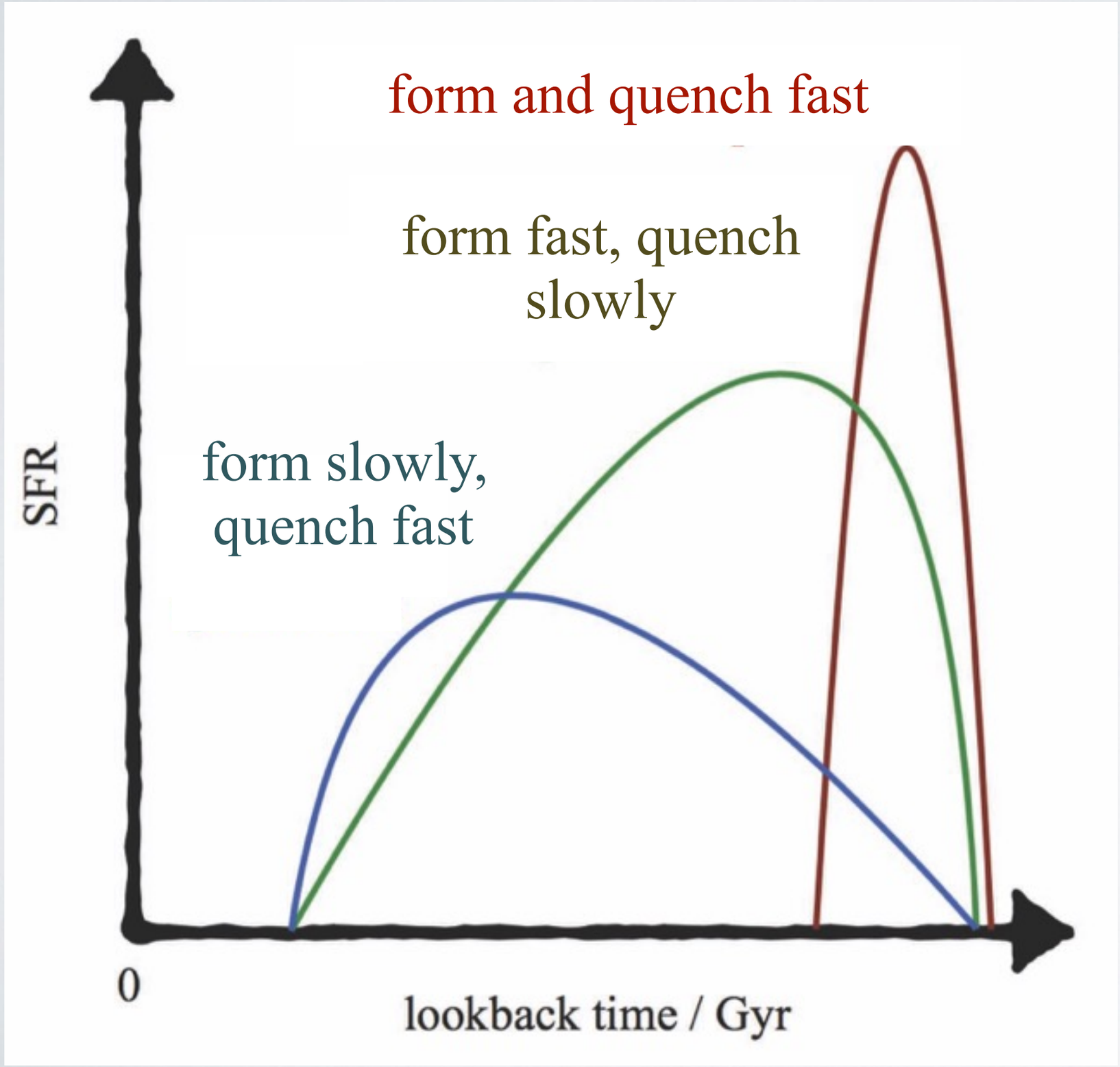

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$10^{11}M_o$, z~2

high mass, low z
$10^{11}M_o$, z~0.4

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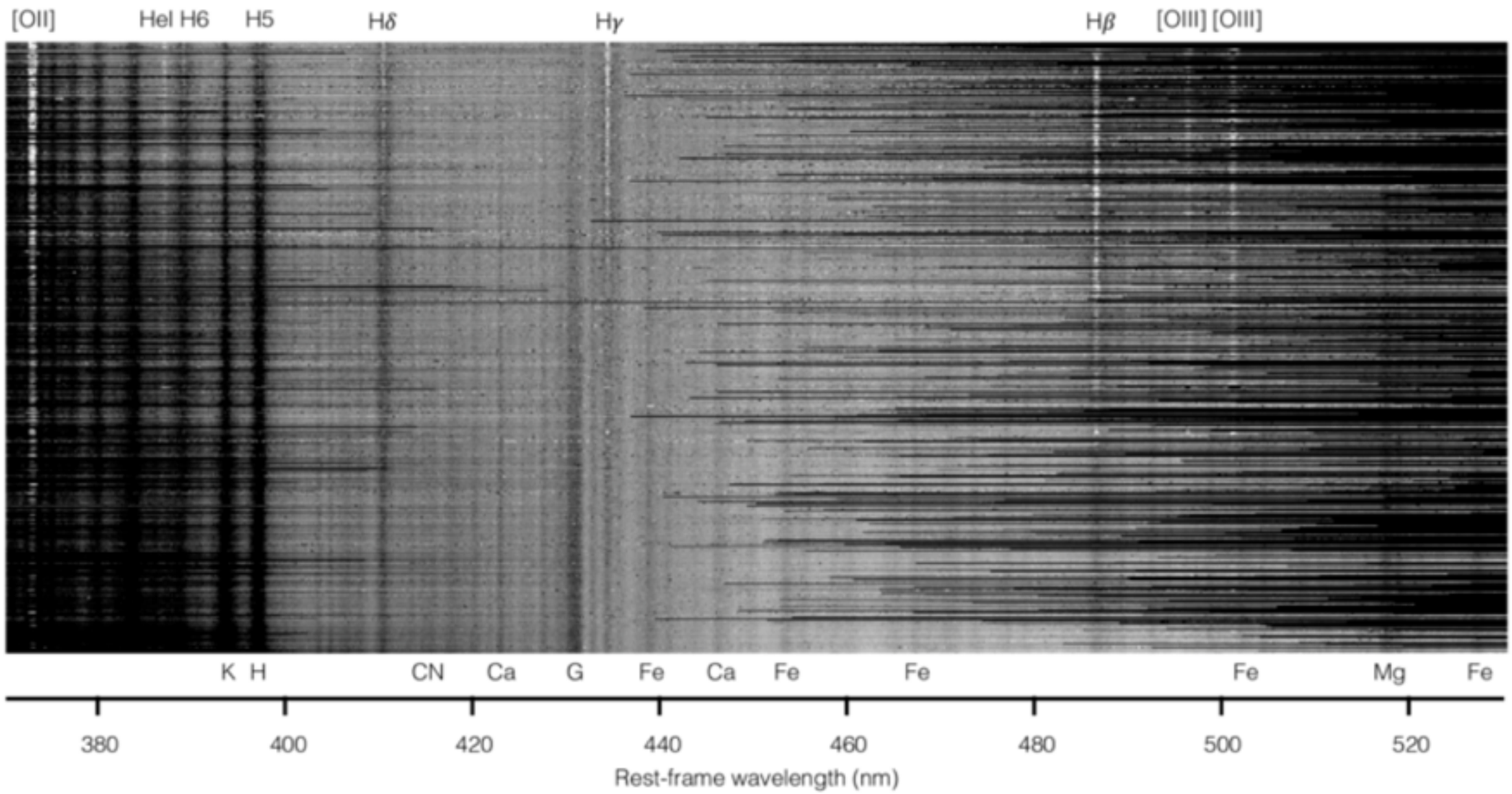
LEGA-C - spectroscopy

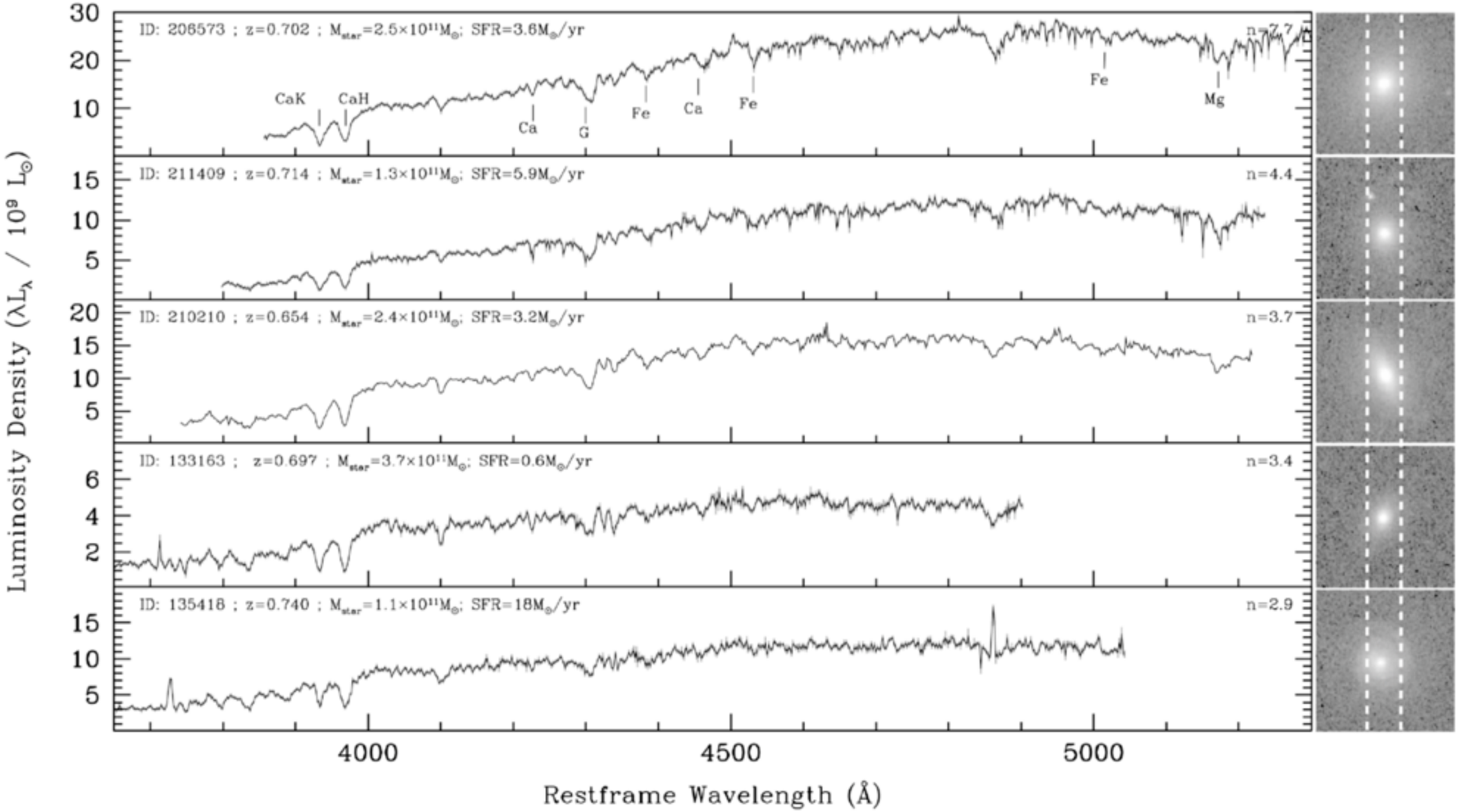
- VLT/VIMOS, in COSMOS field
- 0.6<z<1.0
- targets selected from the UltraVISTA catalog in K band
- In total ~3000 galaxies, ~900 so far

van der Wel et al. 2016



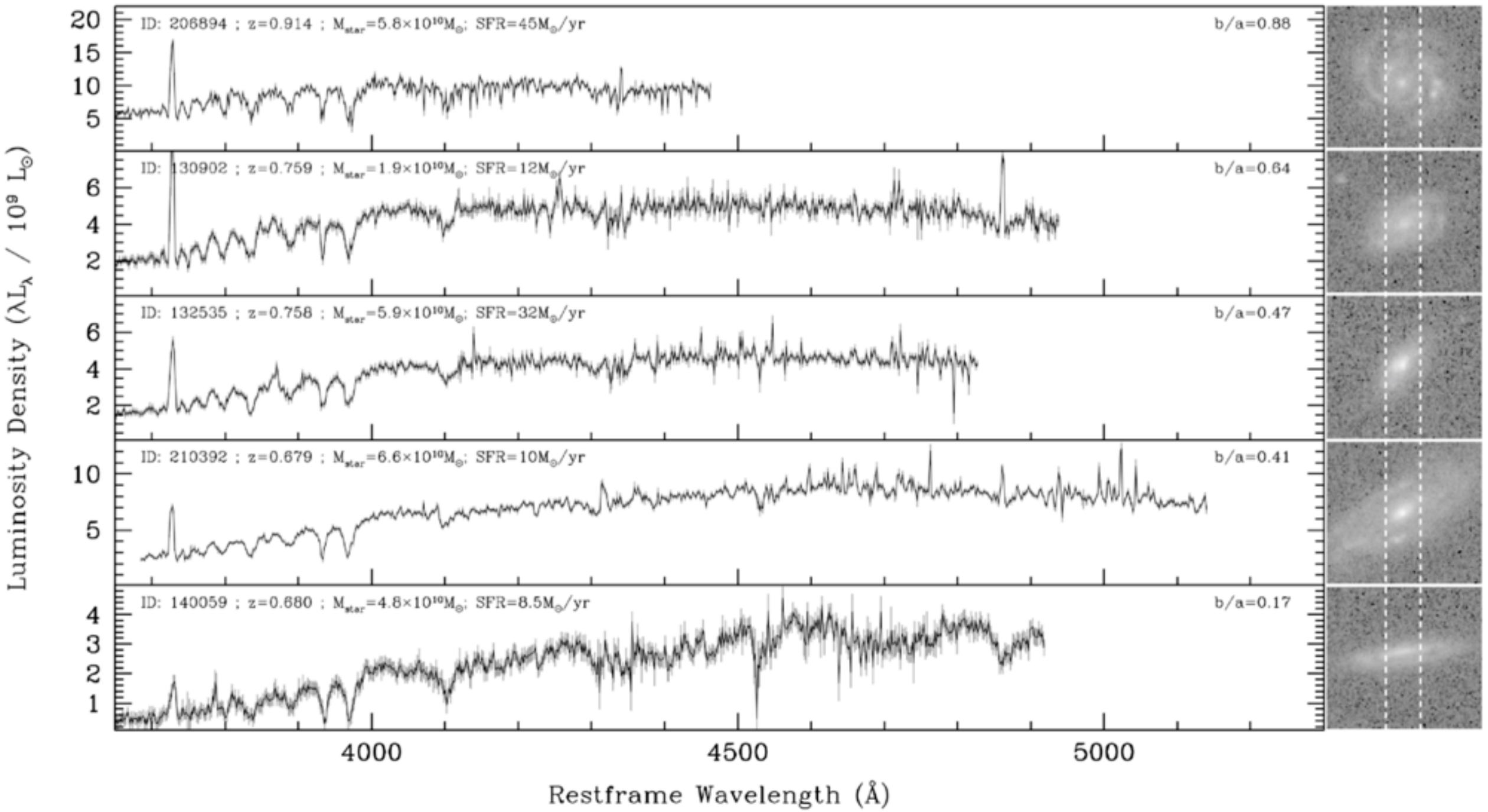
SSFR

LEGA-C



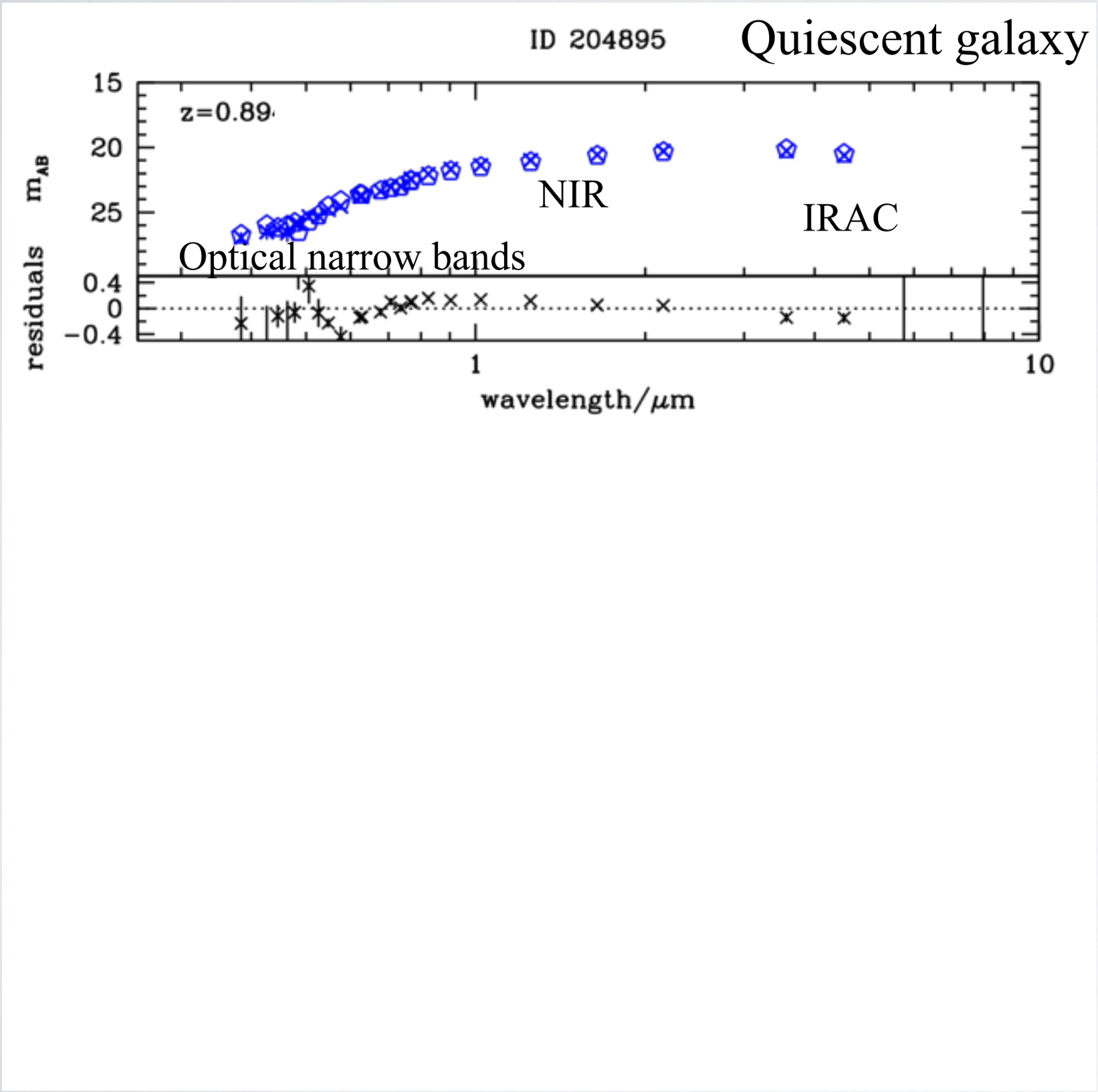
van der Wel et al. 2016

LEGA-C



van der Wel et al. 2016

Fitting procedure - photometry+spectroscopy



UltraVISTA photometry

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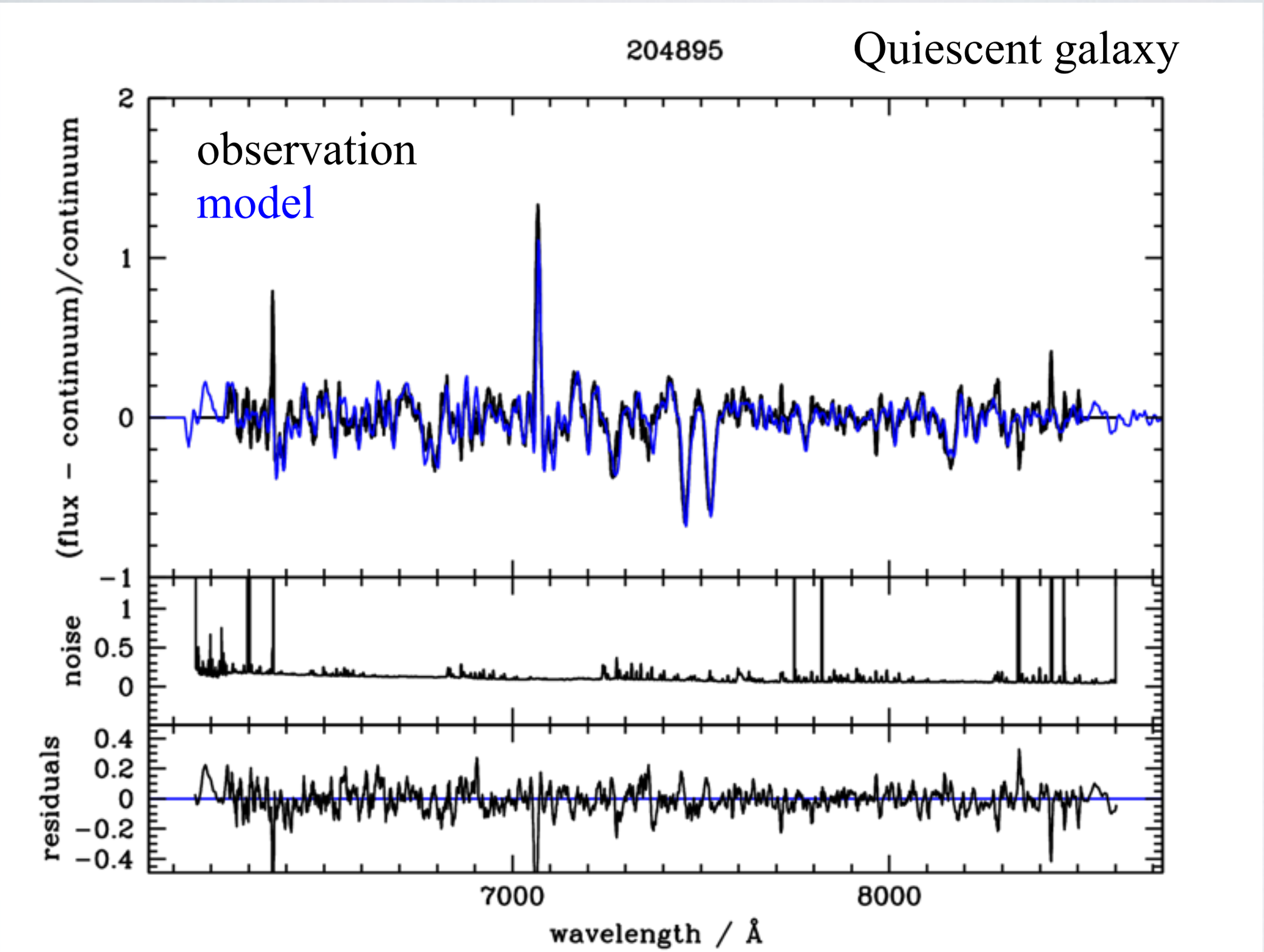

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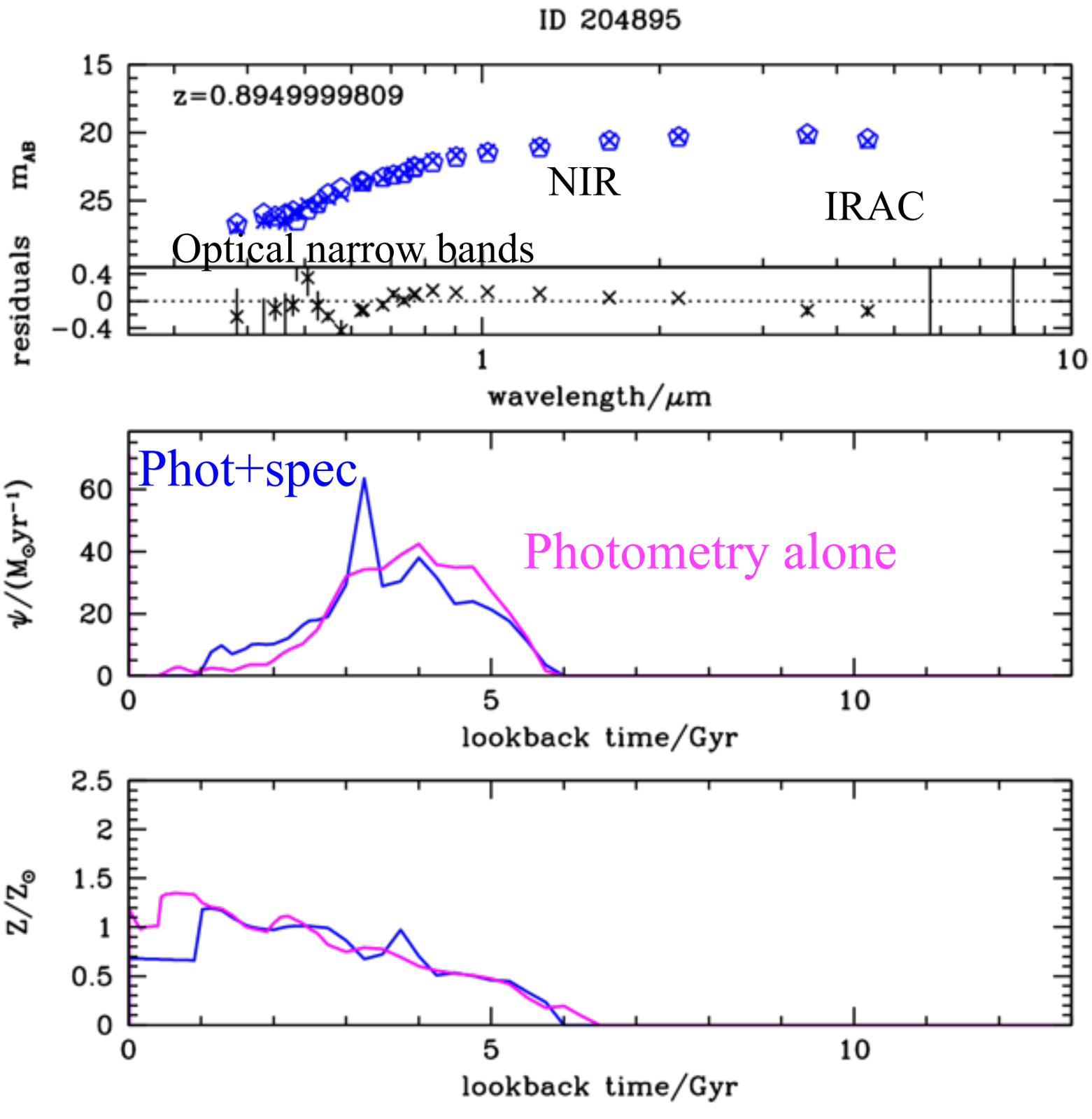

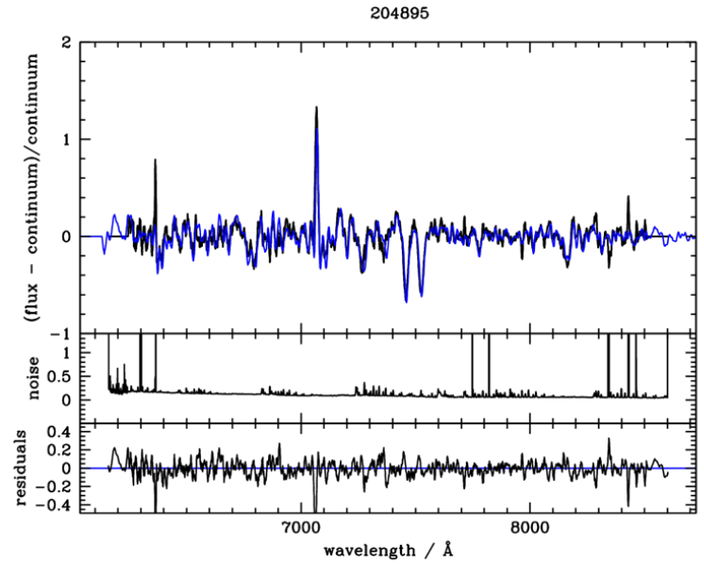

Star formation history

Metal enrichment history

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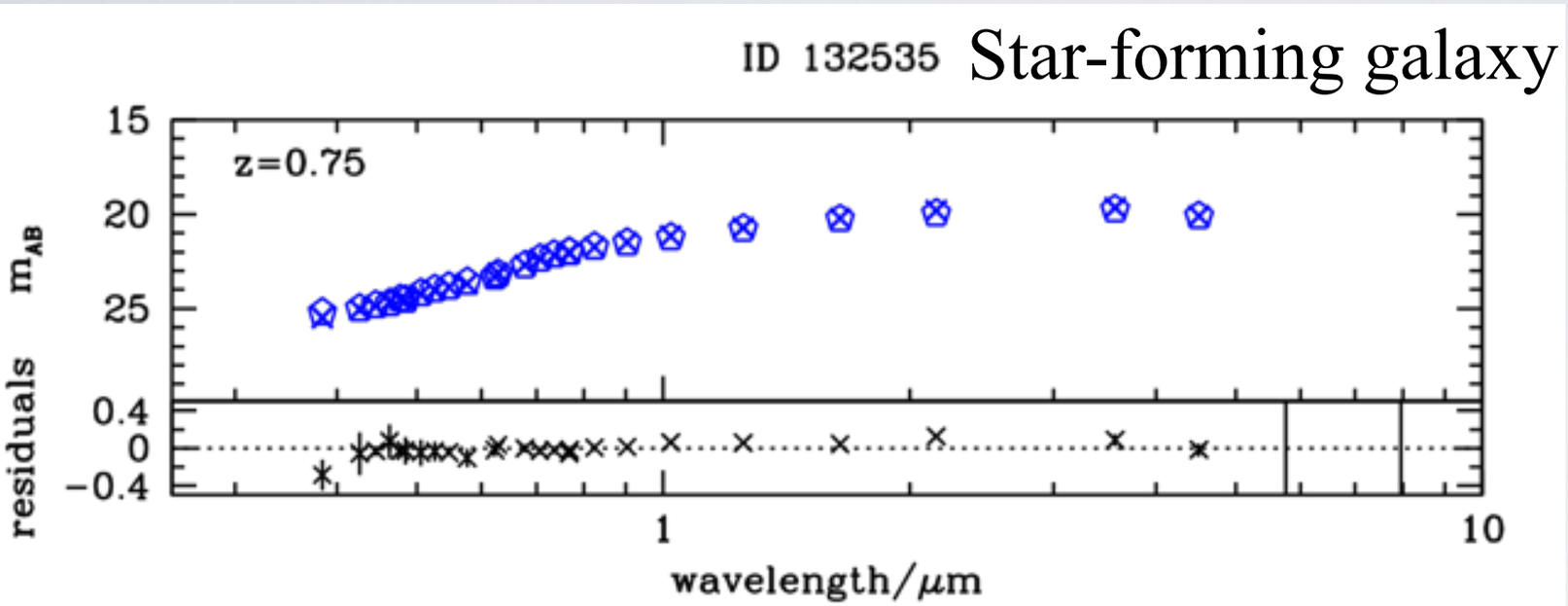

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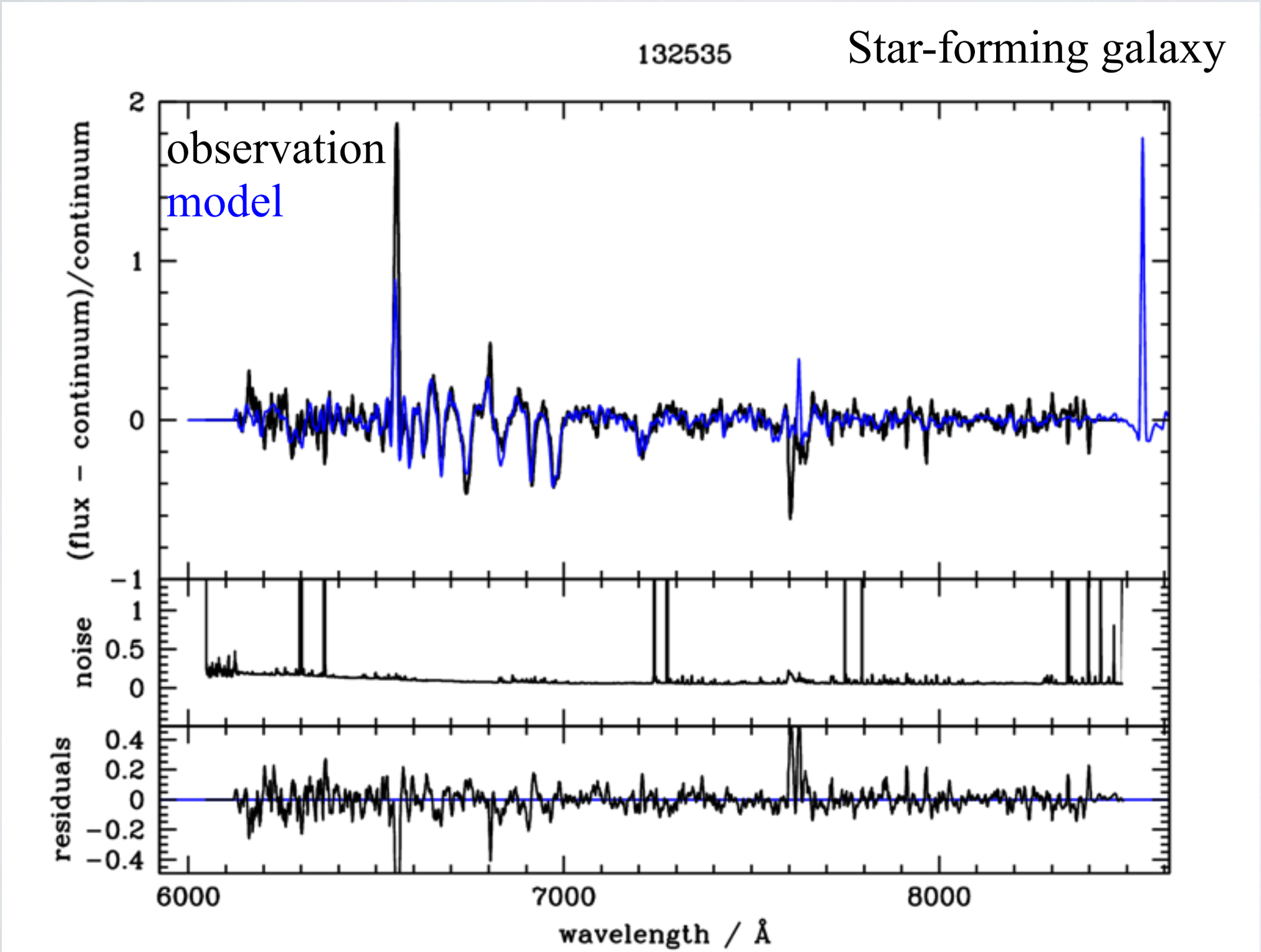

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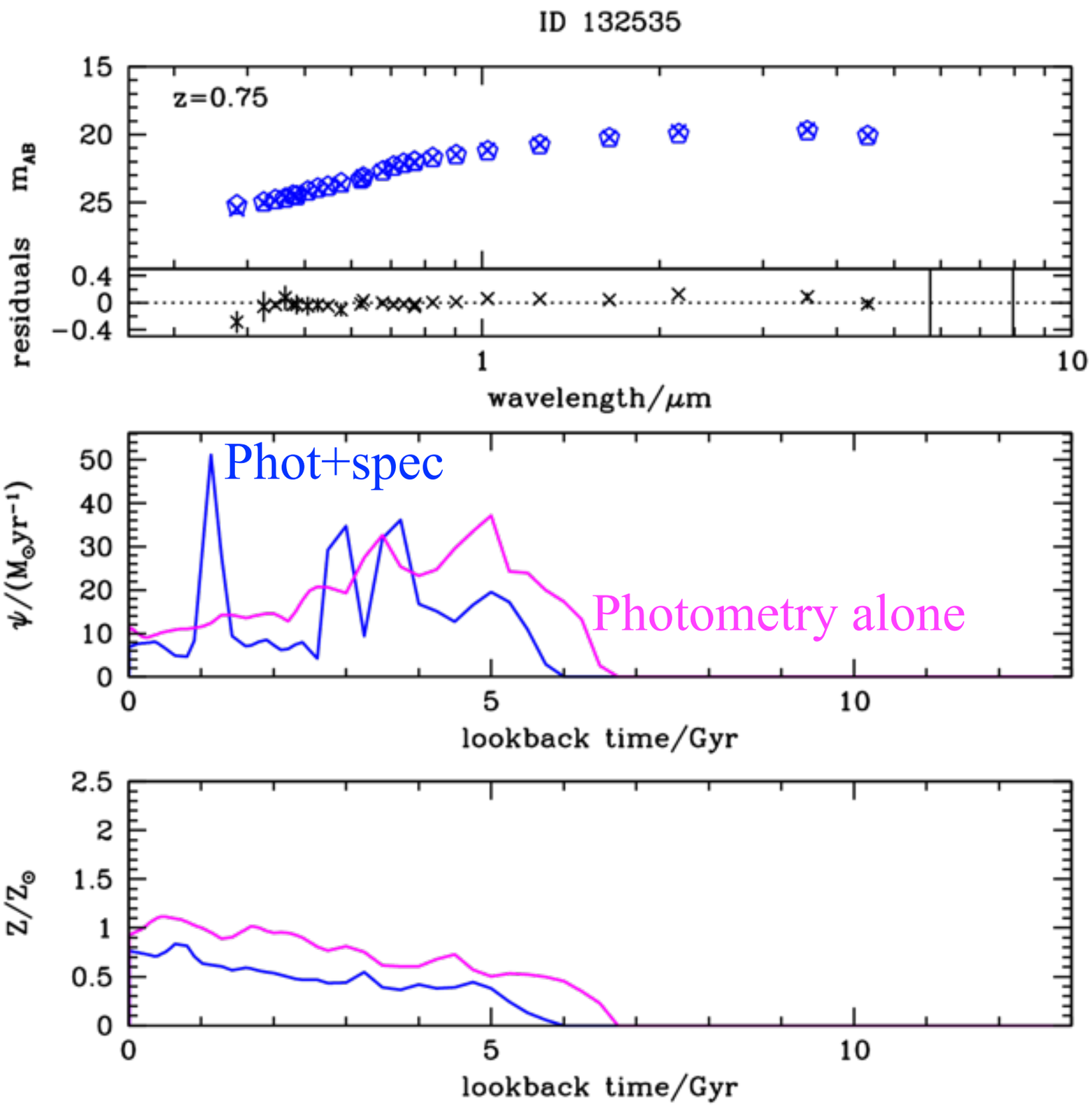

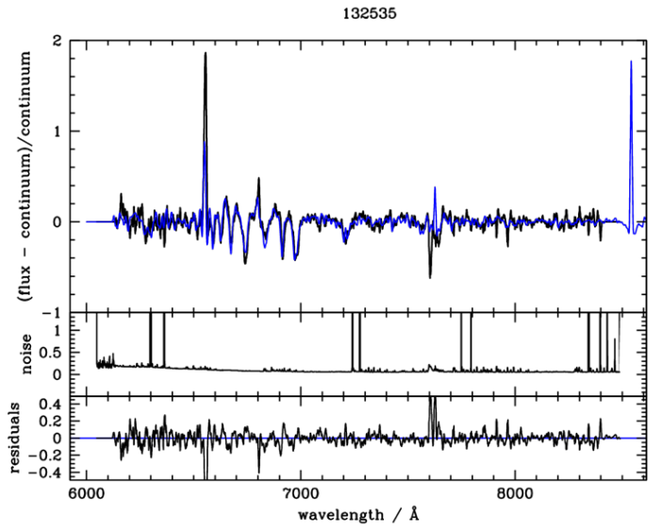

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Julianne Dalcanton: “In Romeo and Juliet, it is not just ‘boy and girl meet, parents don’t approve, boy and girl die’. There is much more than that.”

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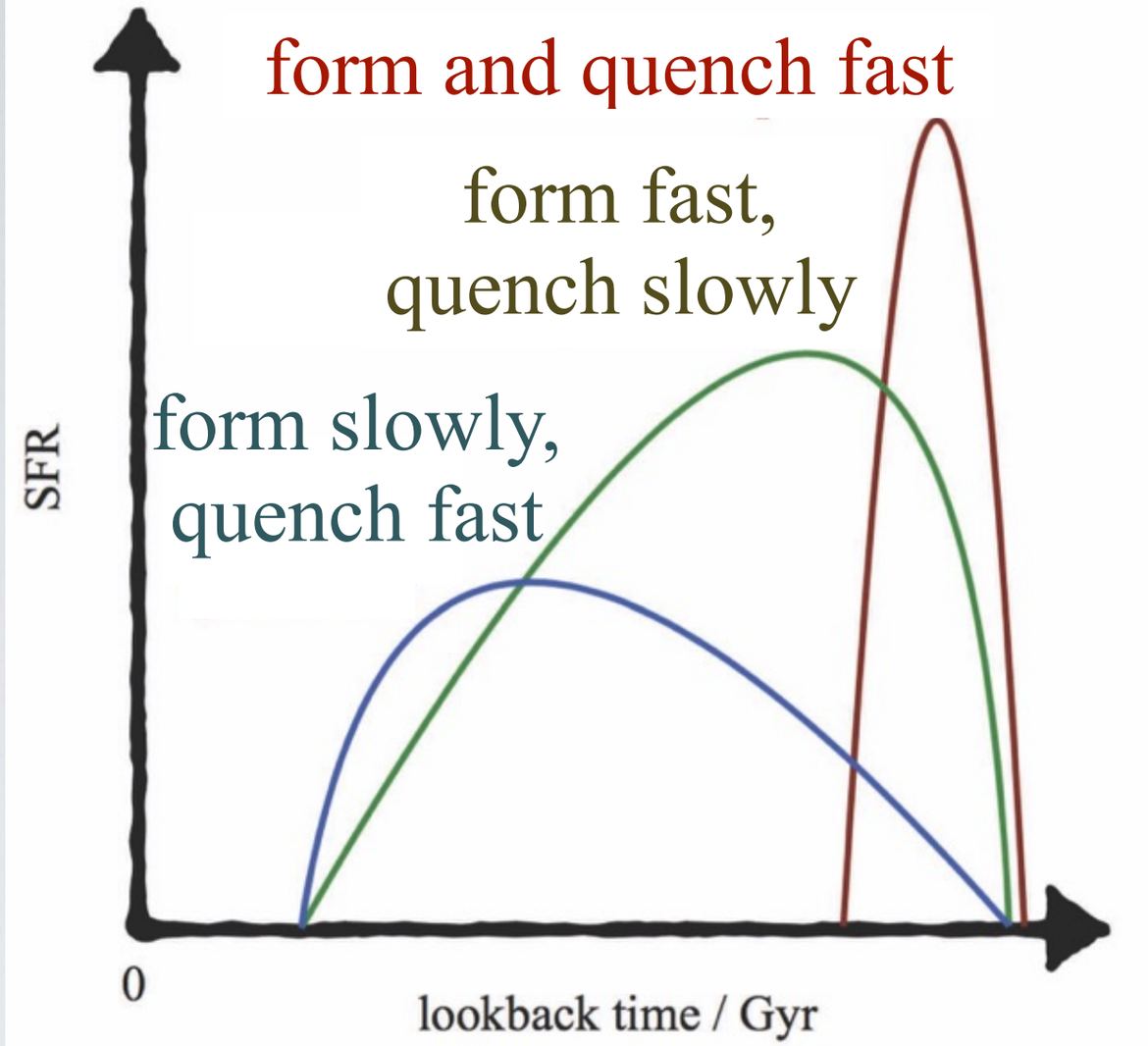

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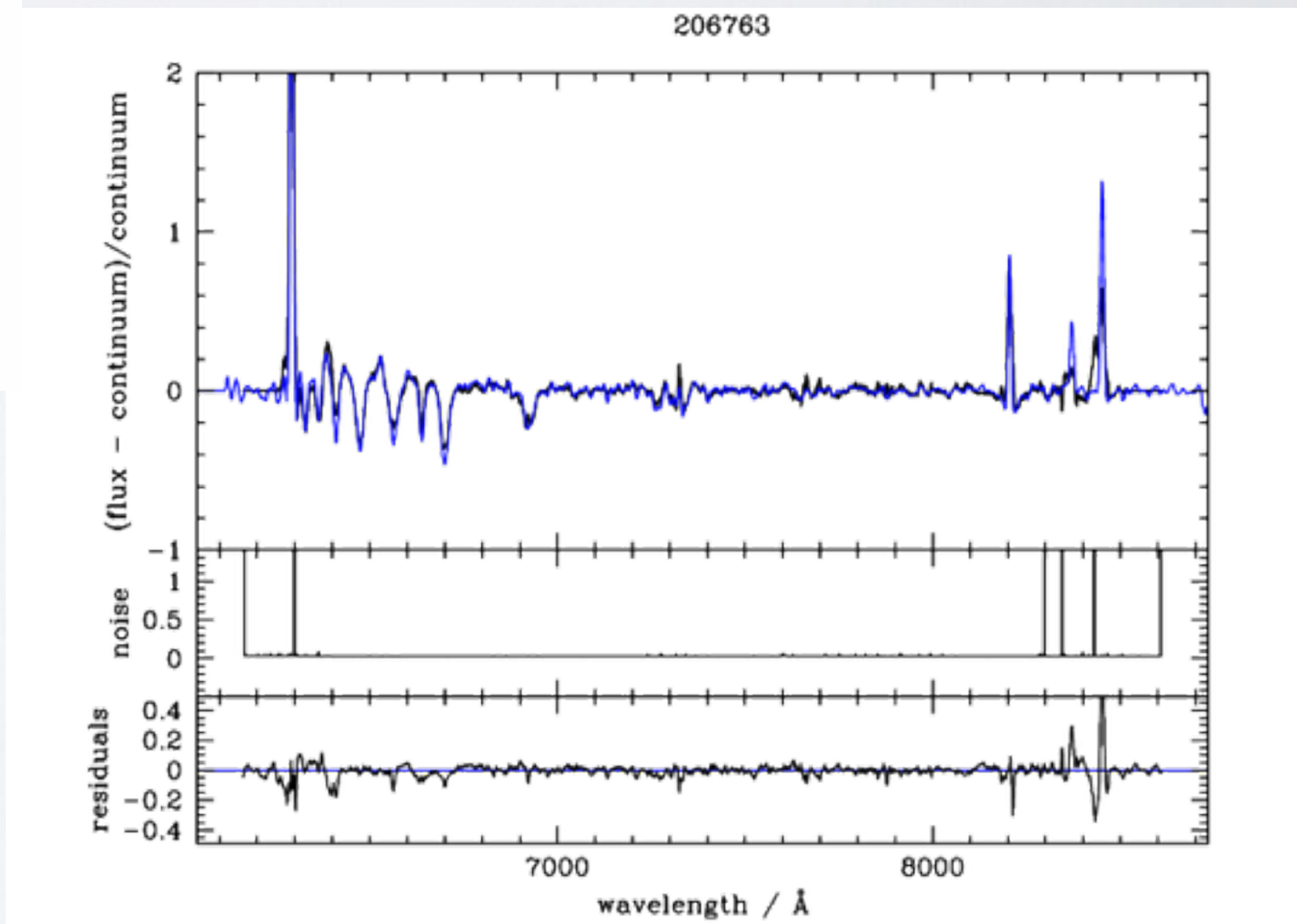

Thanks…Merci…Grazie