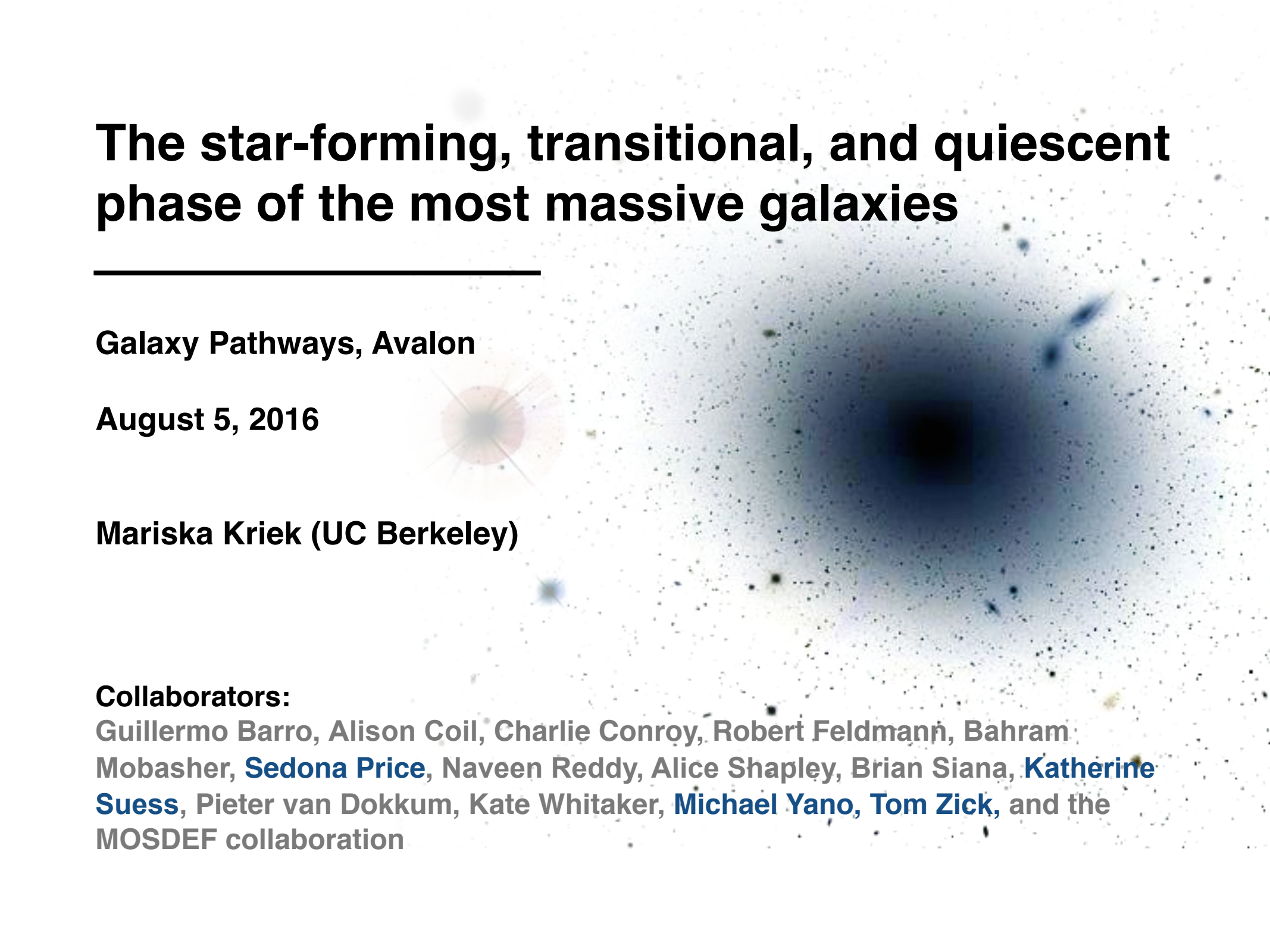
The star-forming, transitional, and quiescent phase of the most massive galaxies



Galaxy Pathways, Avalon

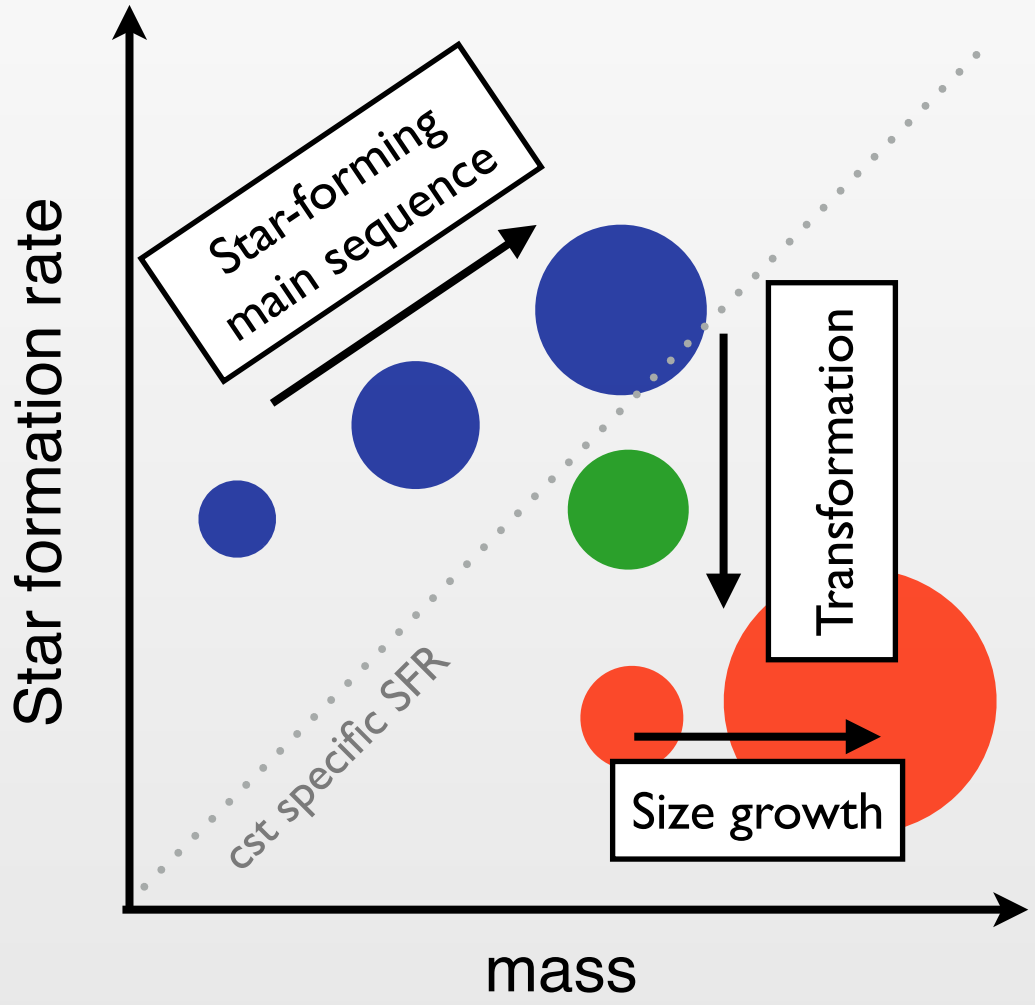
August 5, 2016

Mariska Kriek (UC Berkeley)

Collaborators:
Guillermo Barro, Alison Coil, Charlie Conroy, Robert Feldmann, Bahram Mobasher, Sedona Price, Naveen Reddy, Alice Shapley, Brian Siana, Katherine Suess, Pieter van Dokkum, Kate Whitaker, Michael Yano, Tom Zick, and the MOSDEF collaboration

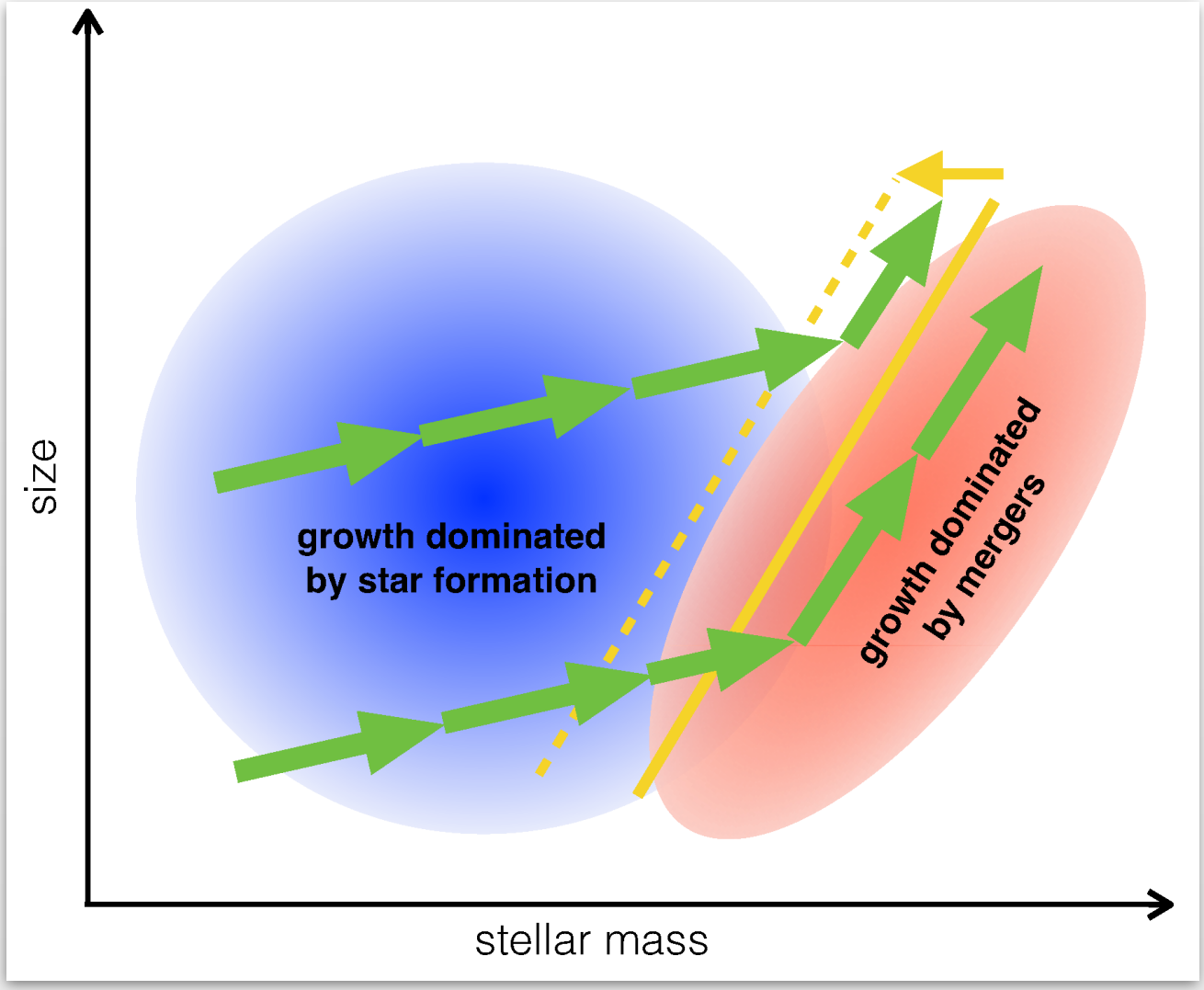
A simple sketch of massive galaxy growth

e.g., van Dokkum et al. (2010), Patel et al. (2013), Barro et al (2014), and many other studies



A simple sketch of massive galaxy growth

van Dokkum et al. (2015)



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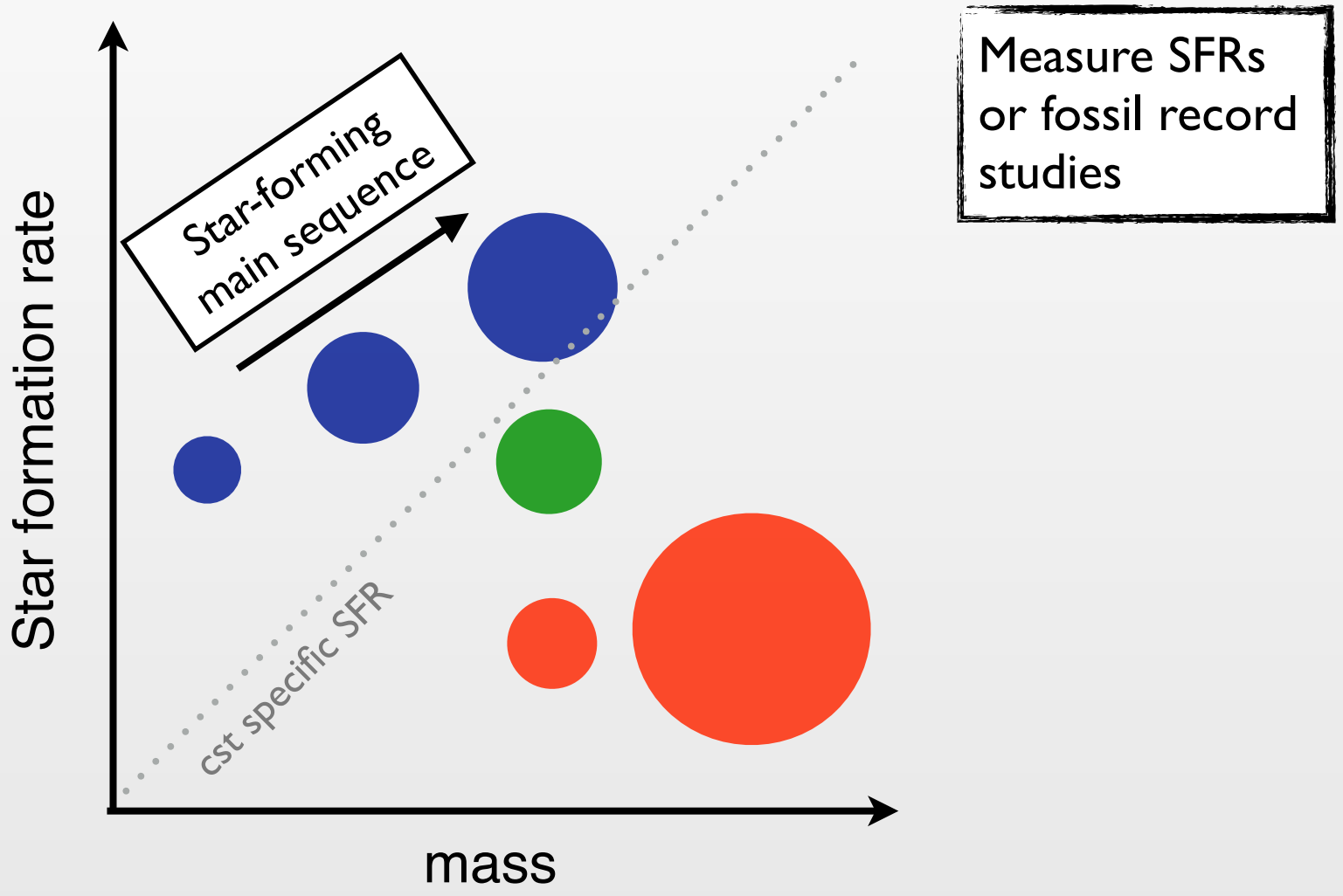
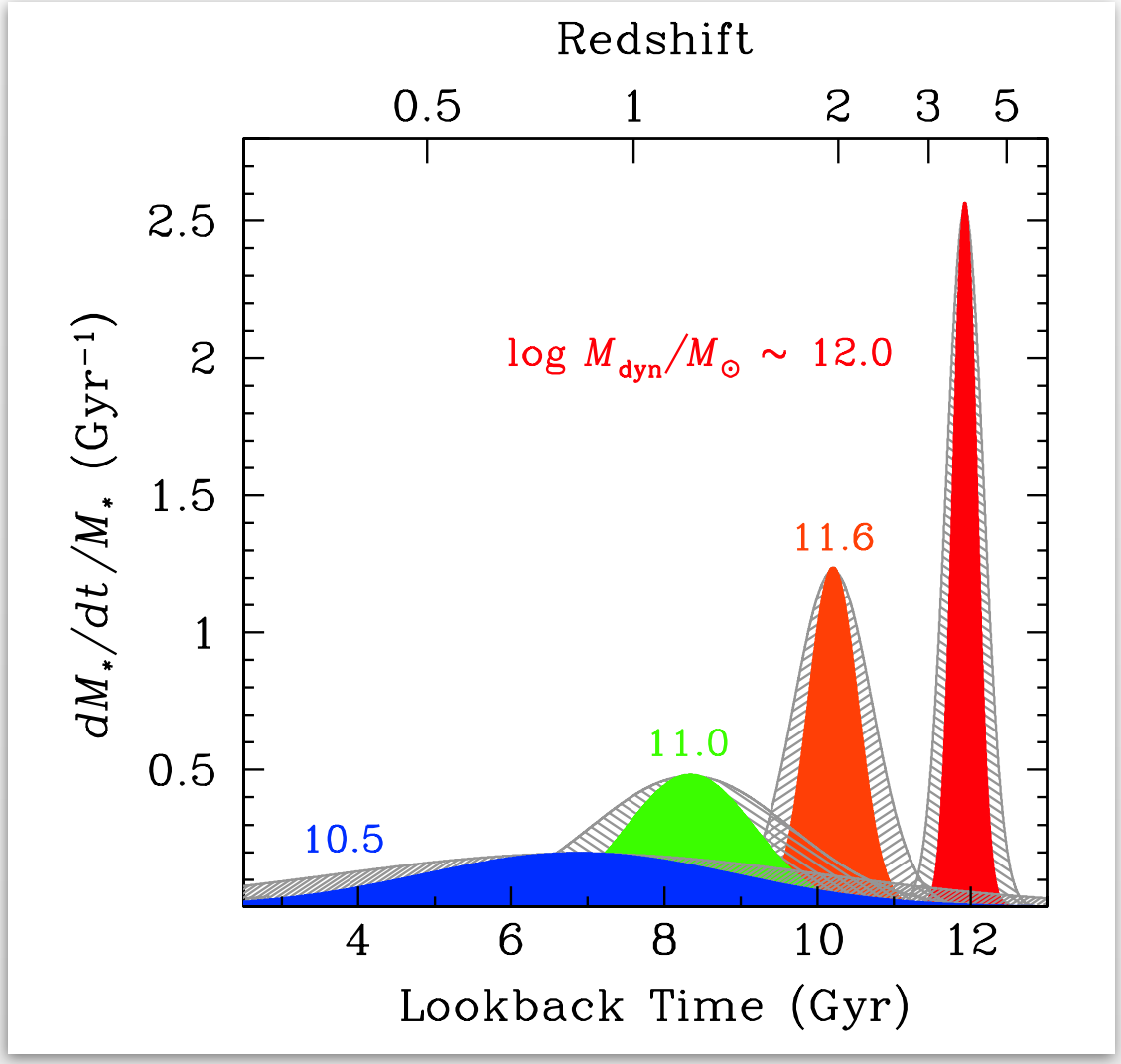
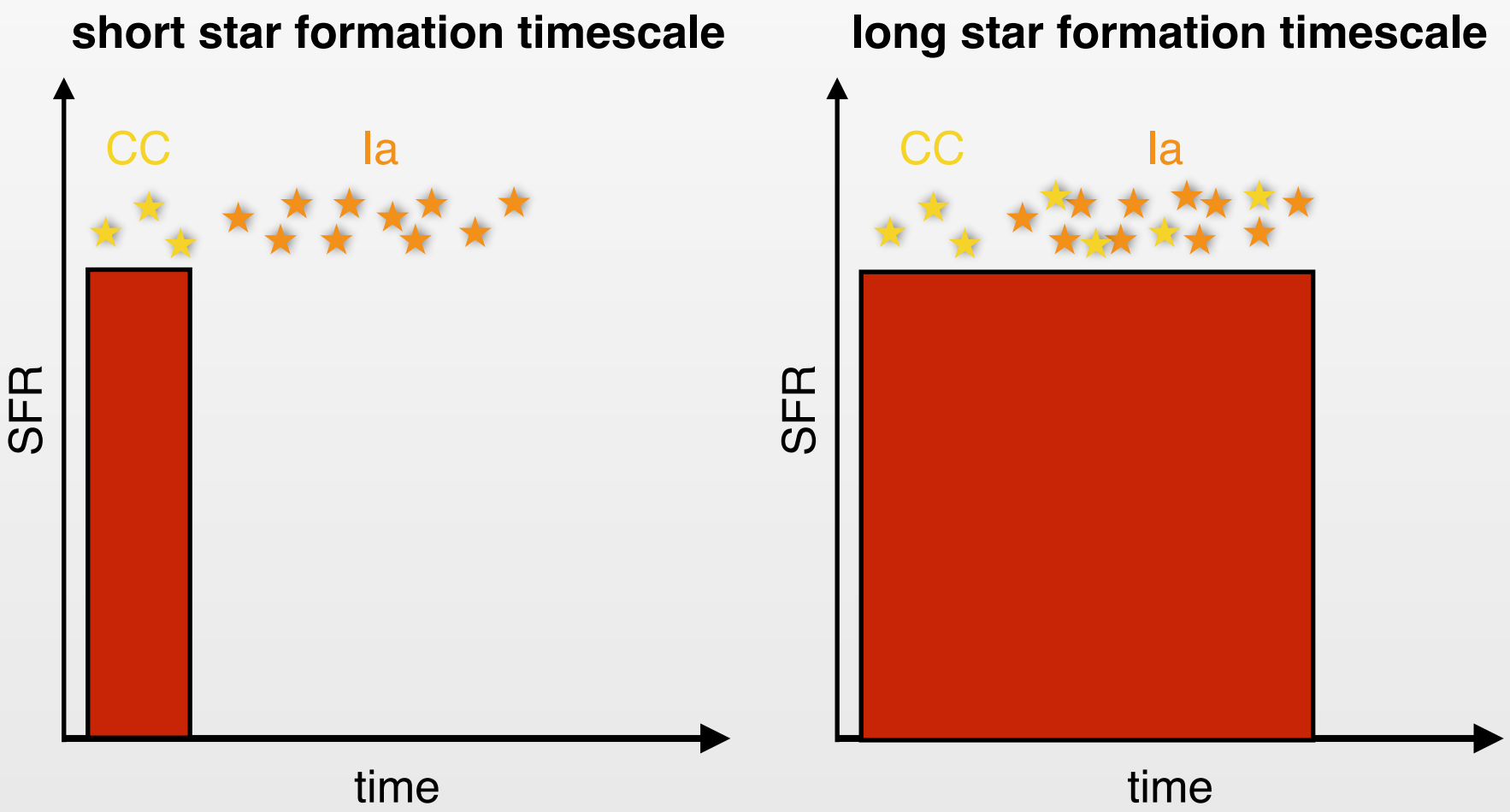


The star-forming phase of massive galaxies

Thomas et al. (2010)



Core-collapse vs. Type Ia supernova enrichment

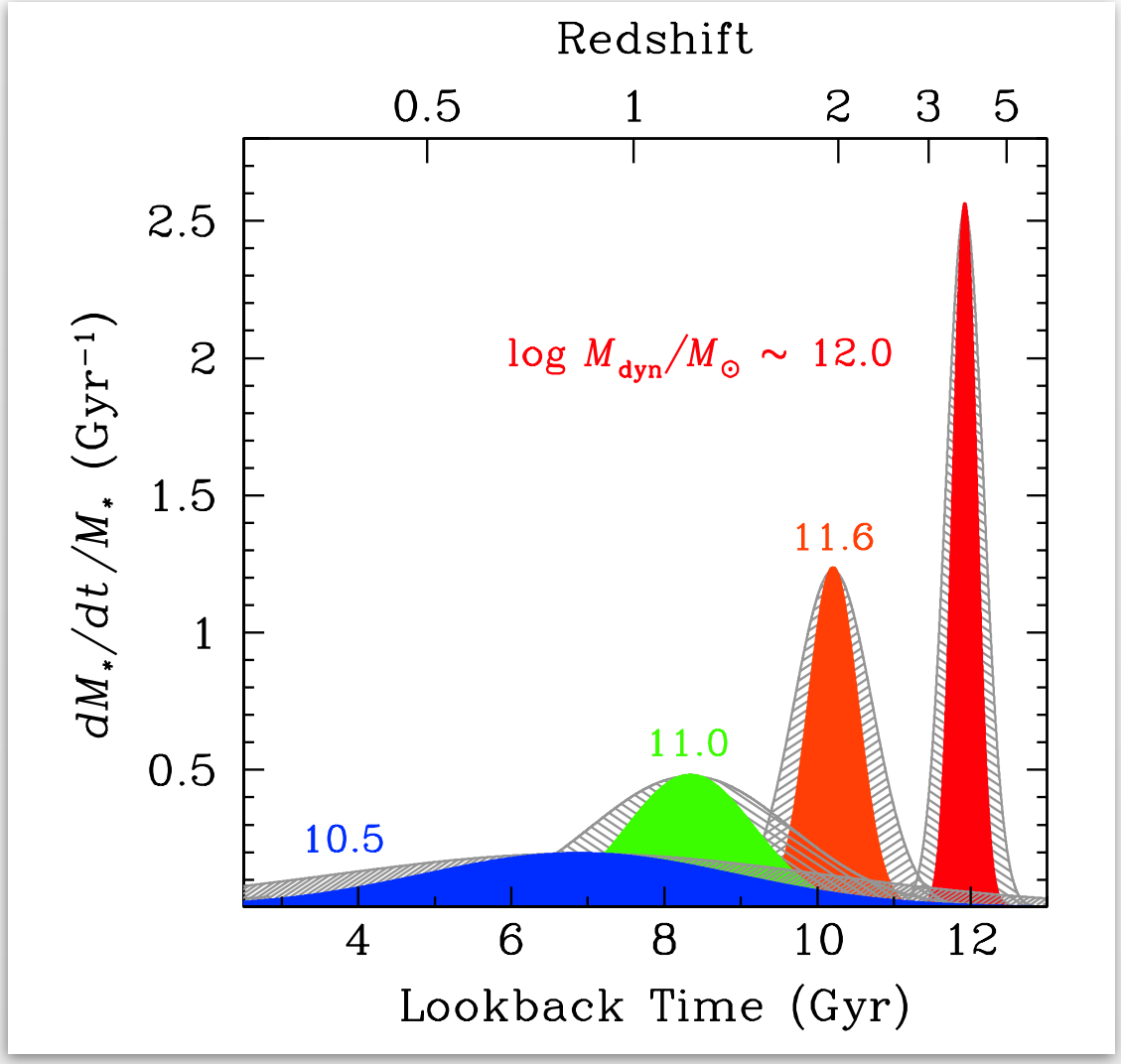


Type Ia products not recycled: high alpha-to-iron ratio

Type Ia products recycled: low alpha-to-iron ratio

The star-forming phase of massive galaxies

Thomas et al. (2010)



A massive compact quiescent galaxy at z~2.1

Kriek, Conroy et al. (submitted)

Embargoed

Also includes data by
Belli et al. (2014) and
MOSDEF (Kriek et al. 2015)

Abundance pattern: chemically extreme galaxy

Kriek, Conroy et al. (submitted), Choi et al. (2014), Conroy & van Dokkum (2012)

Embargoed

What does this mean for the SFH?

Kriek, Conroy et al. (submitted)

Embargoed

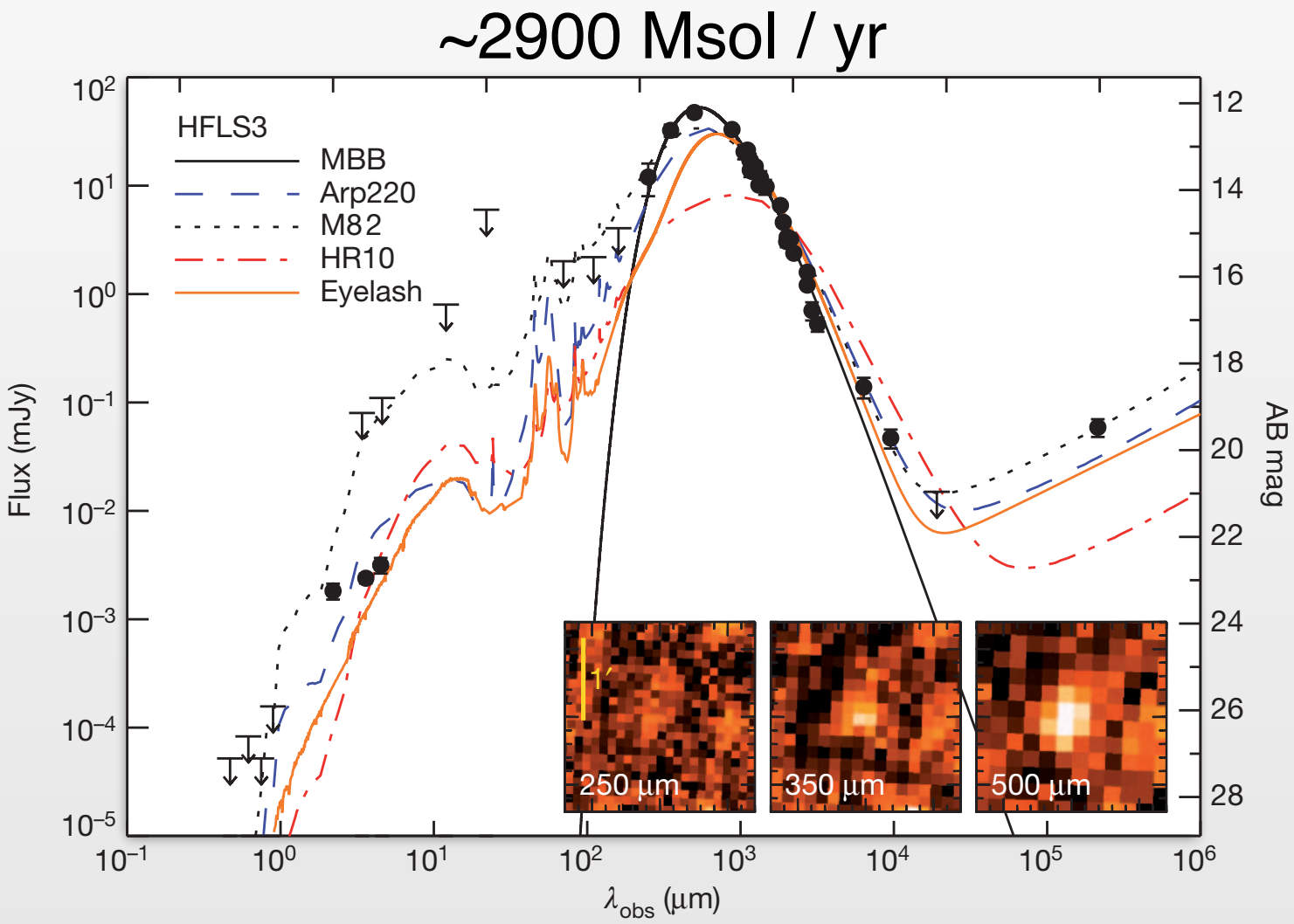
What does this mean for the SFH?

Kriek, Conroy et al. (submitted)

Embargoed

An extreme star-forming galaxy at z=6.34

Riechers et al. (2013)



A simple sketch of massive galaxy growth

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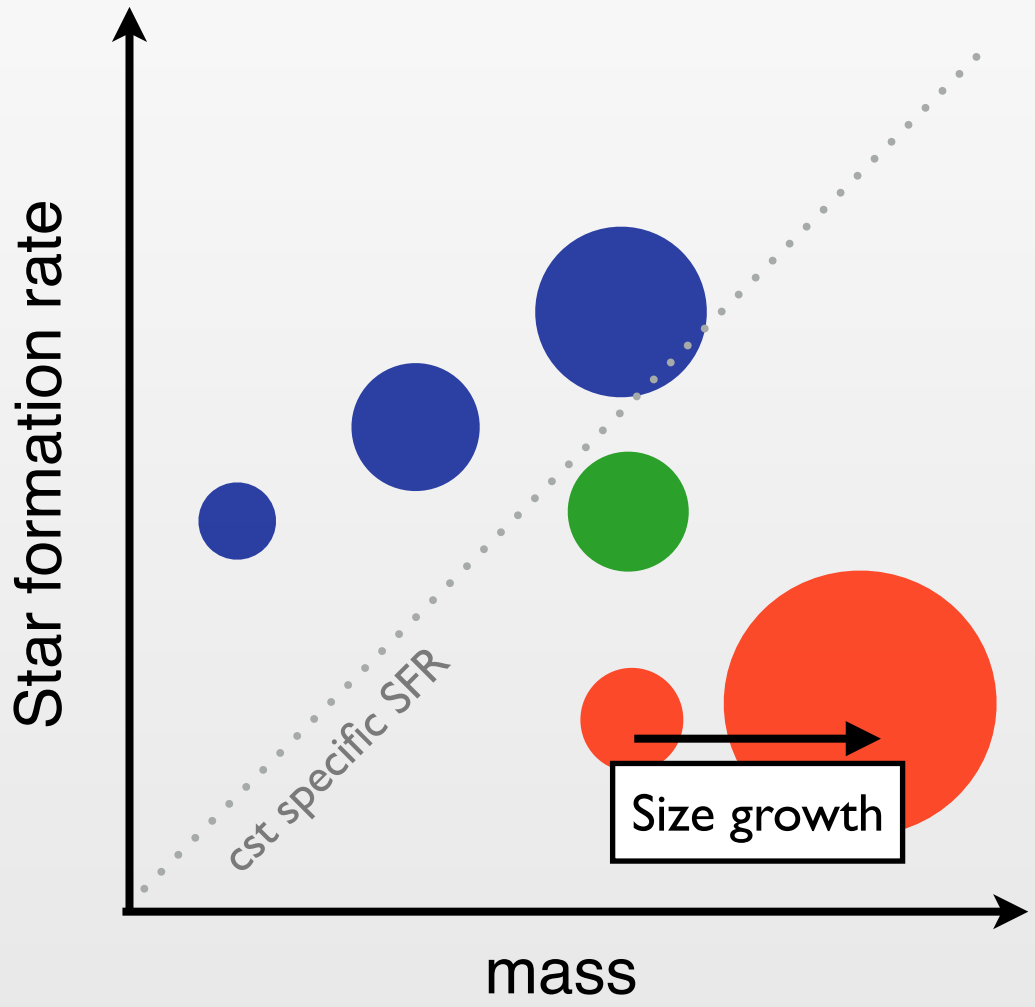


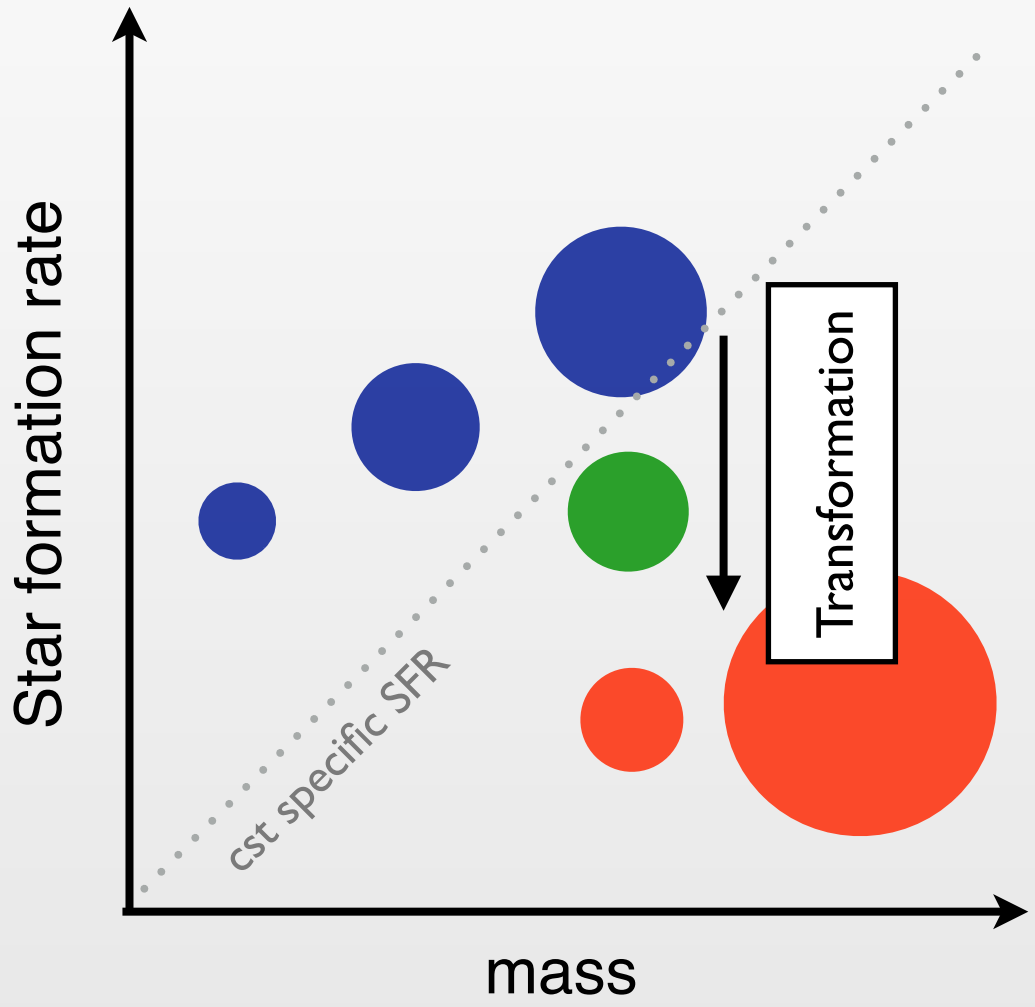
How does this galaxy evolve between z~2 and z~0?

Kriek, Conroy et al. (submitted), Choi et al. (2014), Conroy & van Dokkum (2012)

Embargoed

A simple sketch of massive galaxy growth

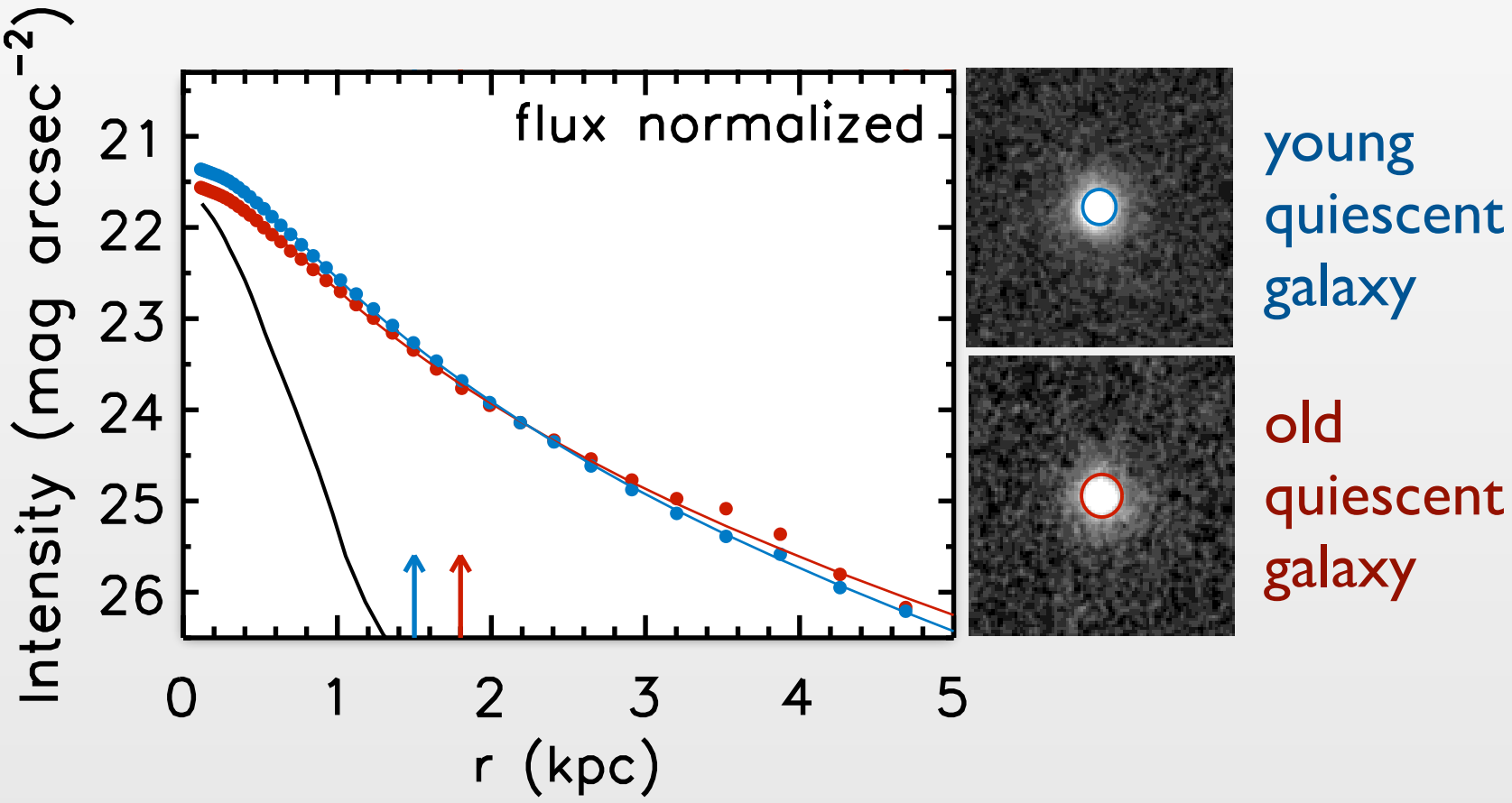
e.g., van Dokkum et al. (2010), Patel et al. (2013), Barro et al (2014)



Study sizes and SFHs of transitional population at z~2 in relation to other galaxy populations

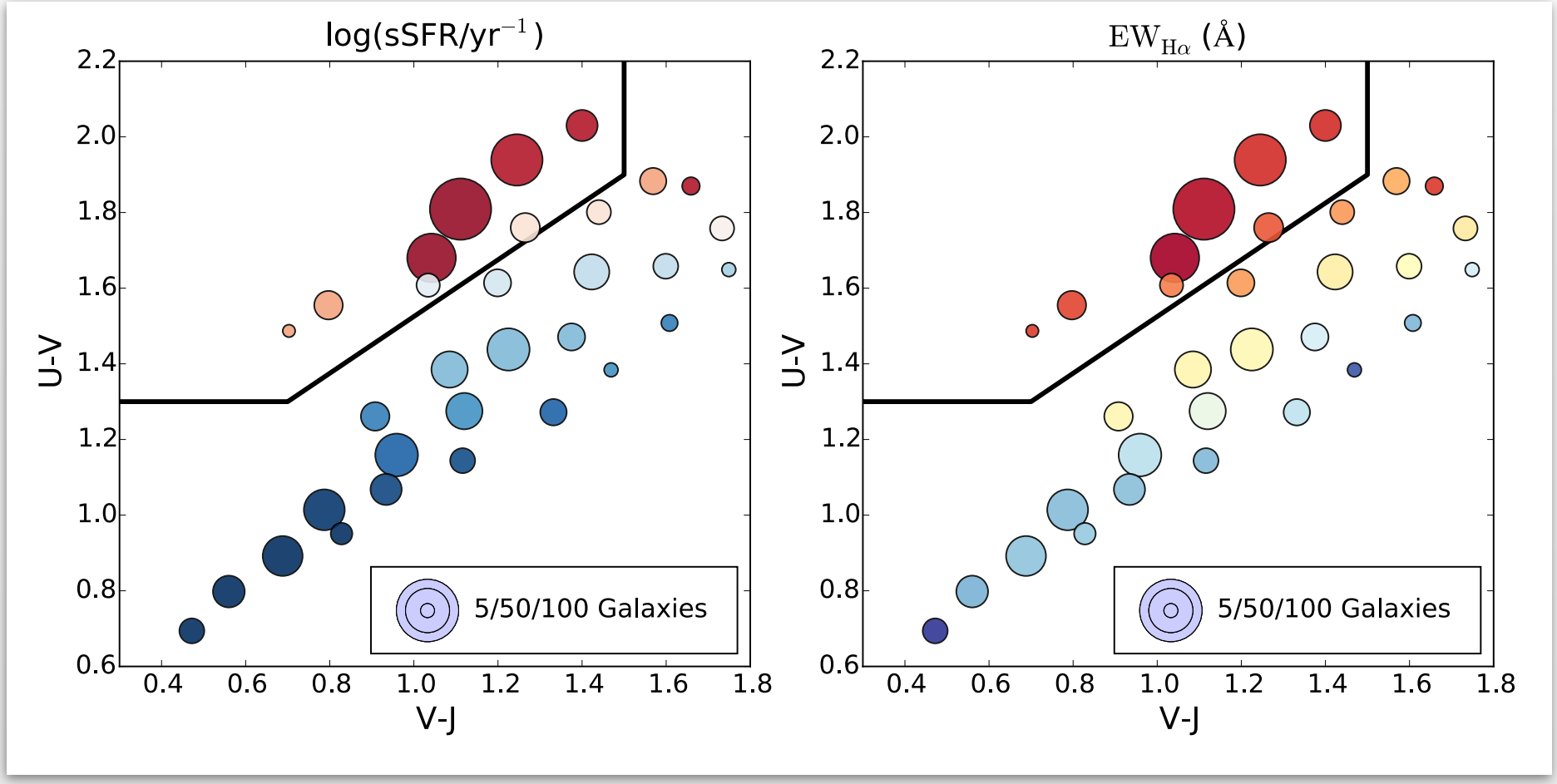
Size difference quiescent and post-starburst galaxies

Whitaker, Kriek, et al. (2012)



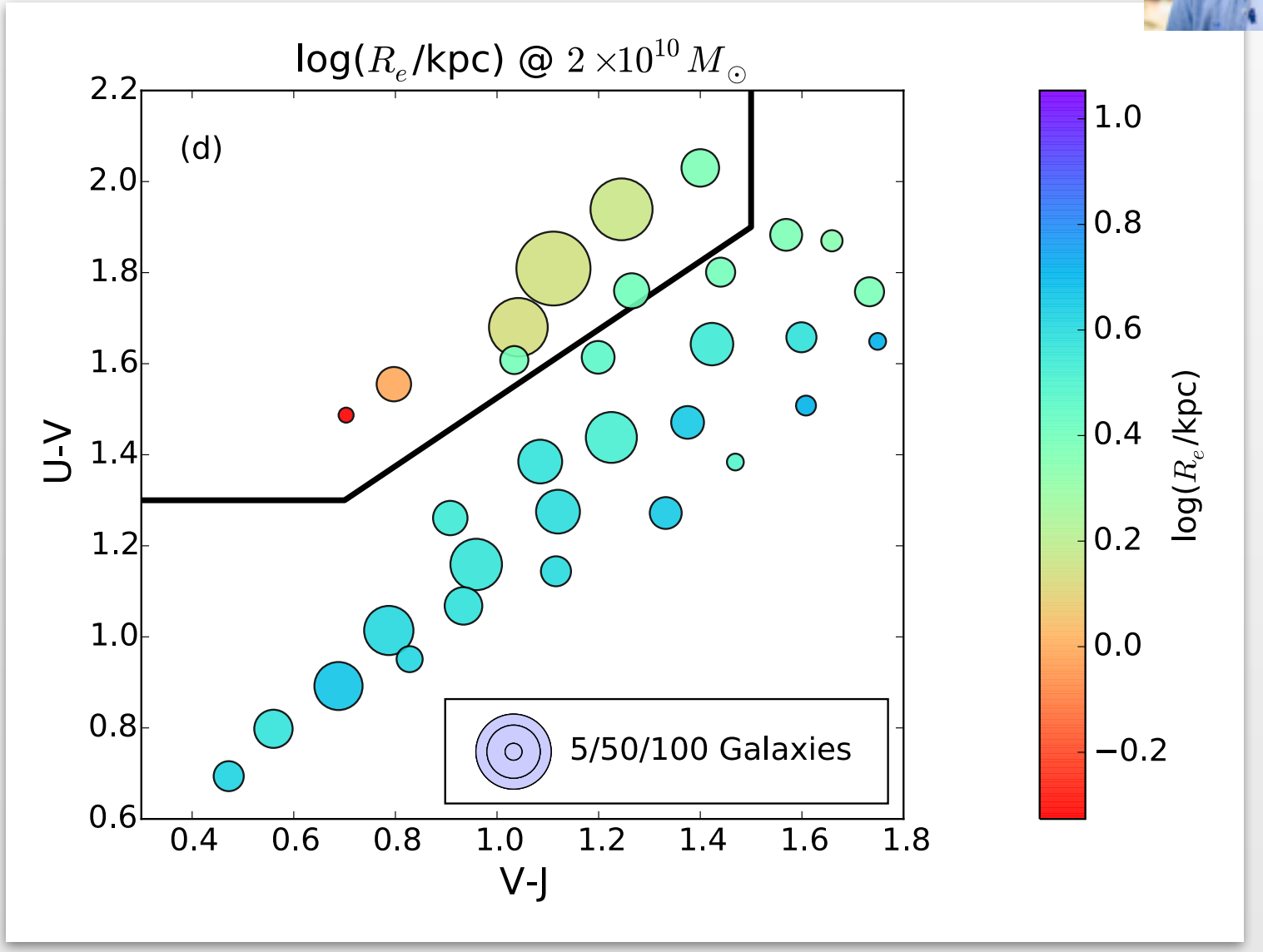
Identifying transitional galaxy types

Yano, Kriek et al. (2016) - Based on composite SEDs



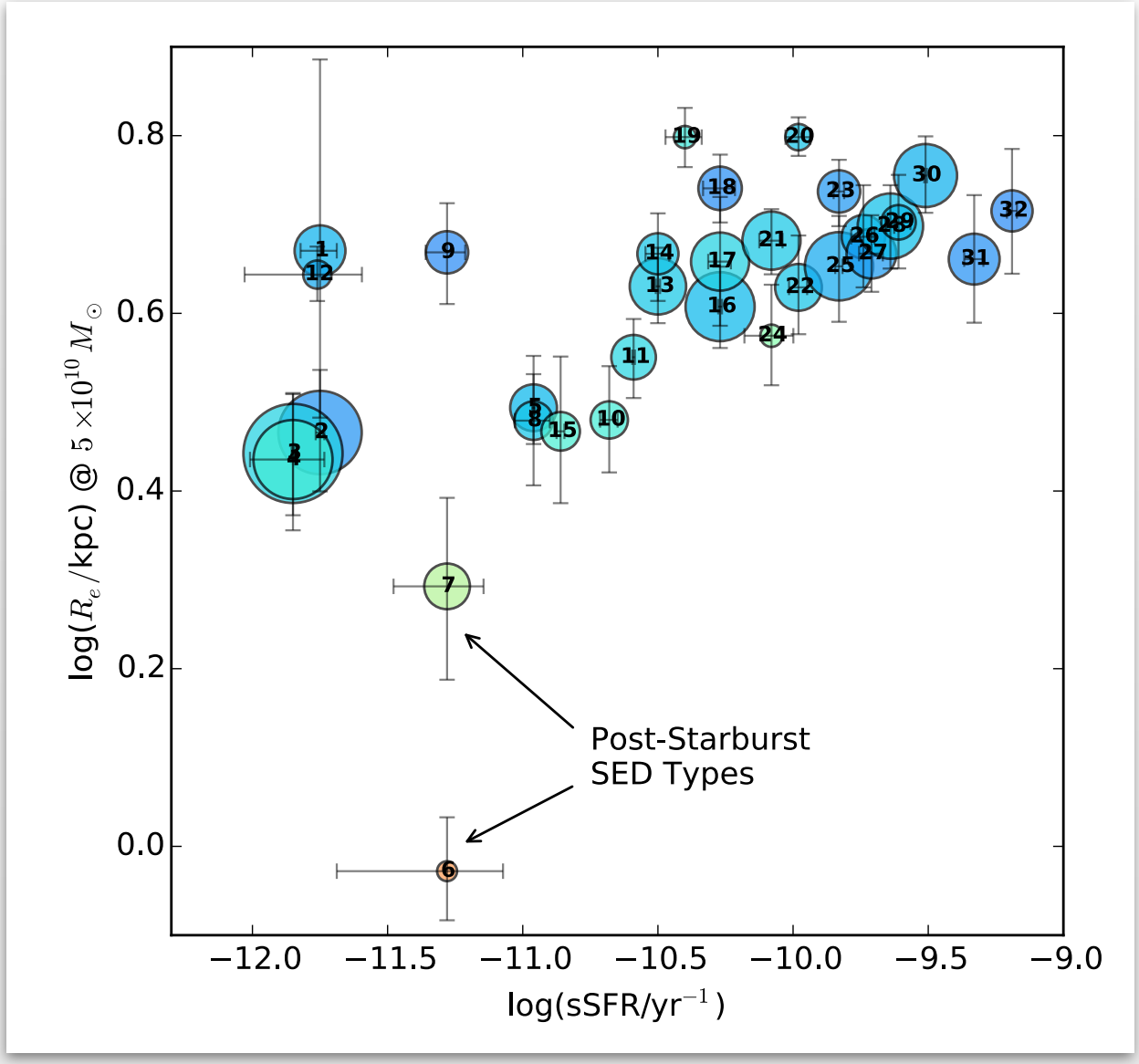
Sizes as a function of spectral type

Yano, Kriek et al. (2016) - HST/CANDELS & composite SEDs



Sizes vs specific star formation rate

Yano, Kriek et al. (2016) - HST/CANDELS & composite SEDs



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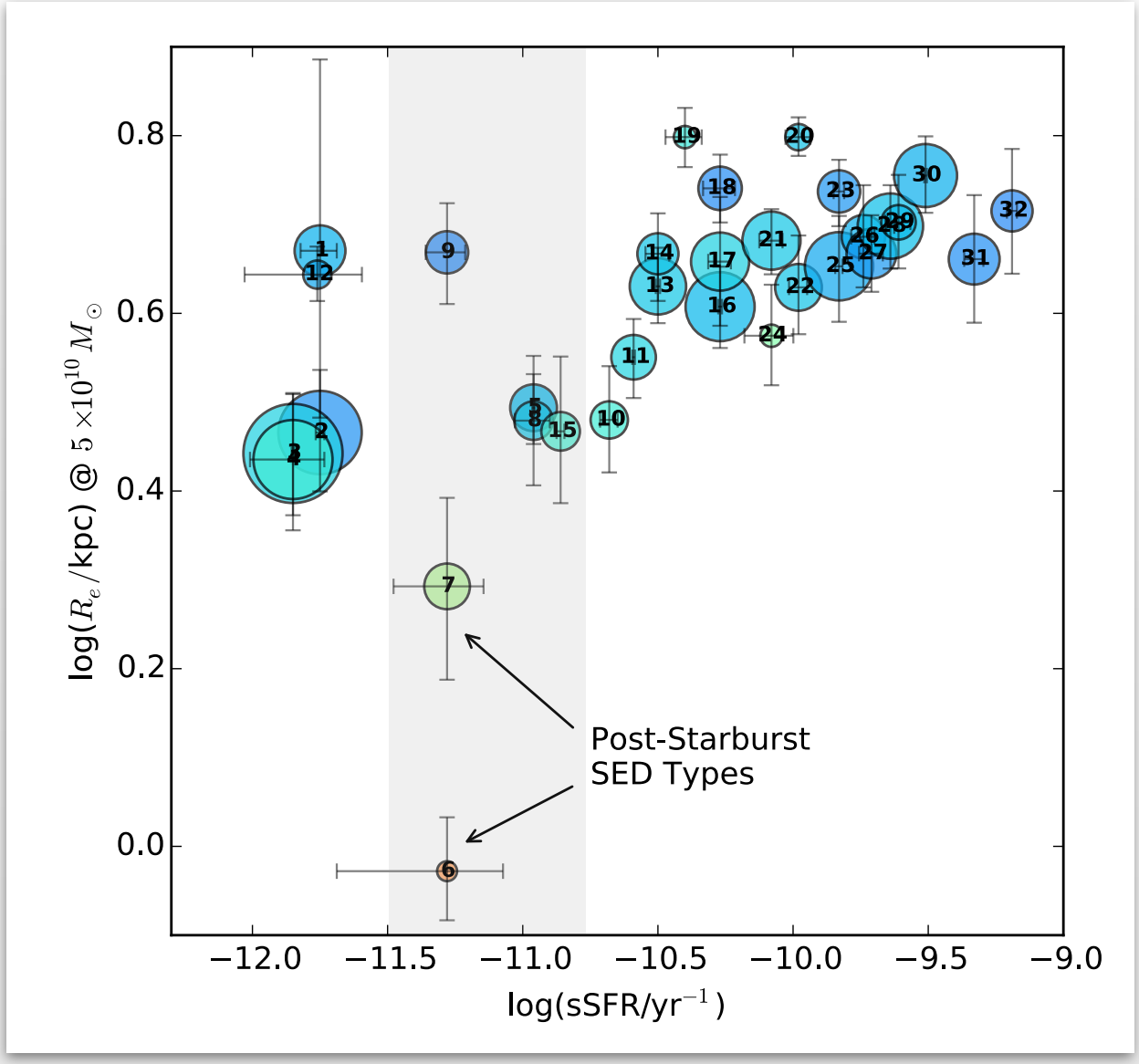


The actual sizes of post-starburst galaxies are even smaller

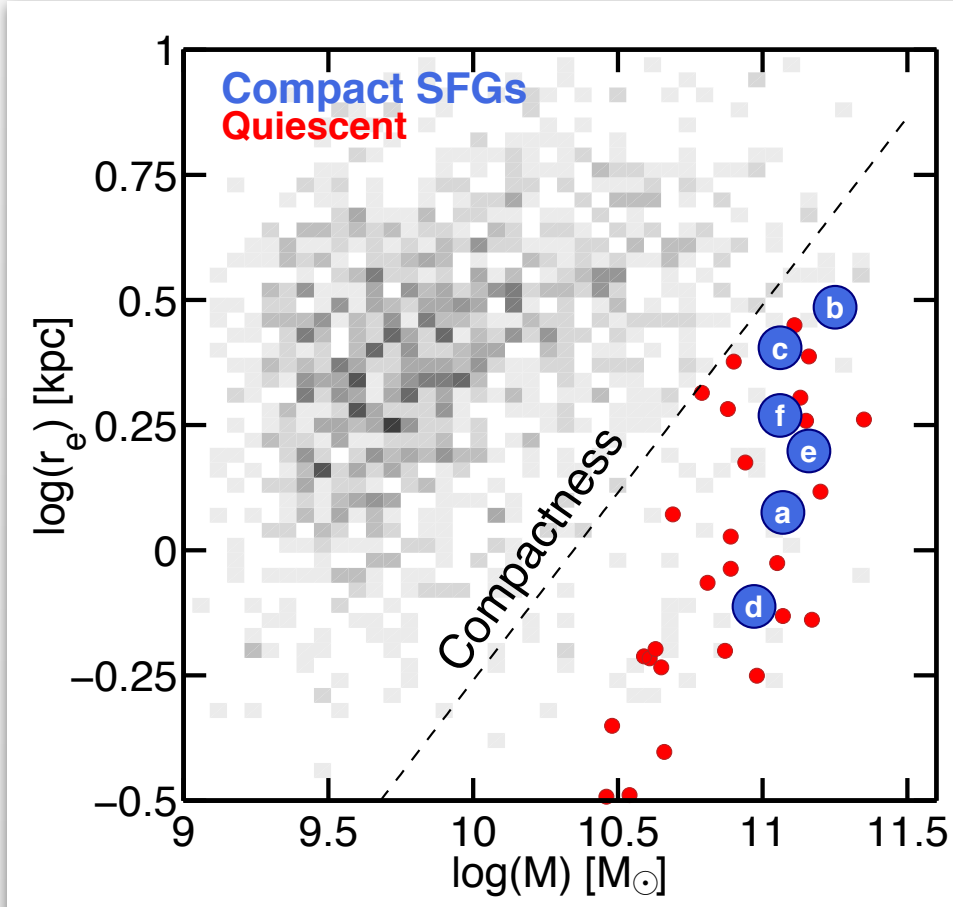
Suess, Kriek, Barro et al. (in prep) - see poster

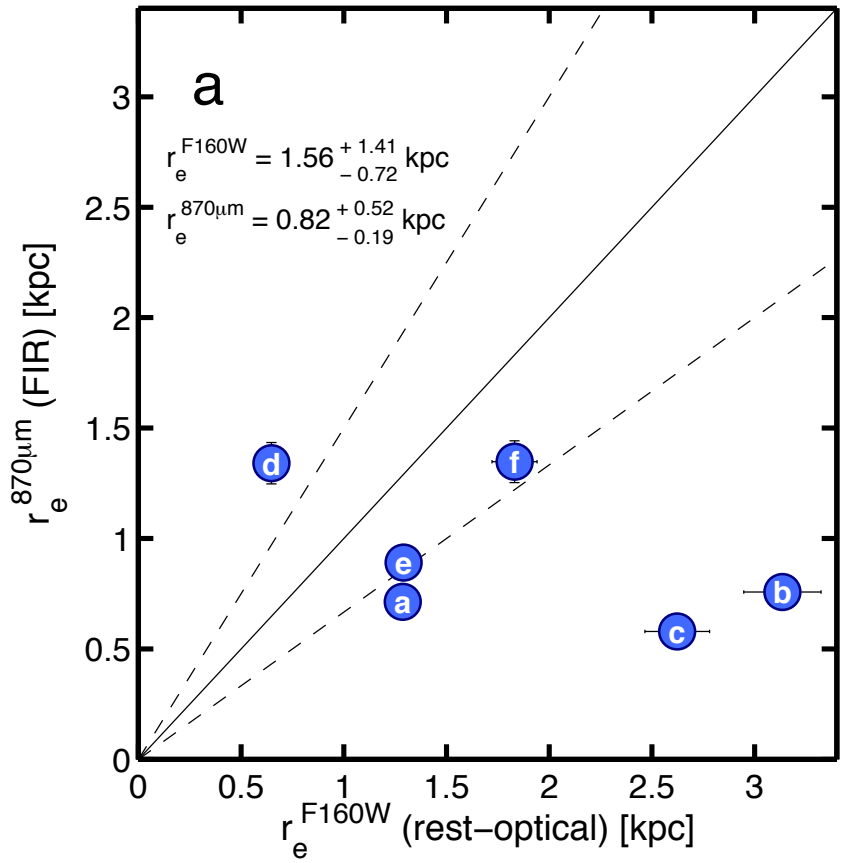
Embargoed

Compact star-forming galaxies: ALMA

Barro, Kriek, Perez-Gonzalez et al. (2016)

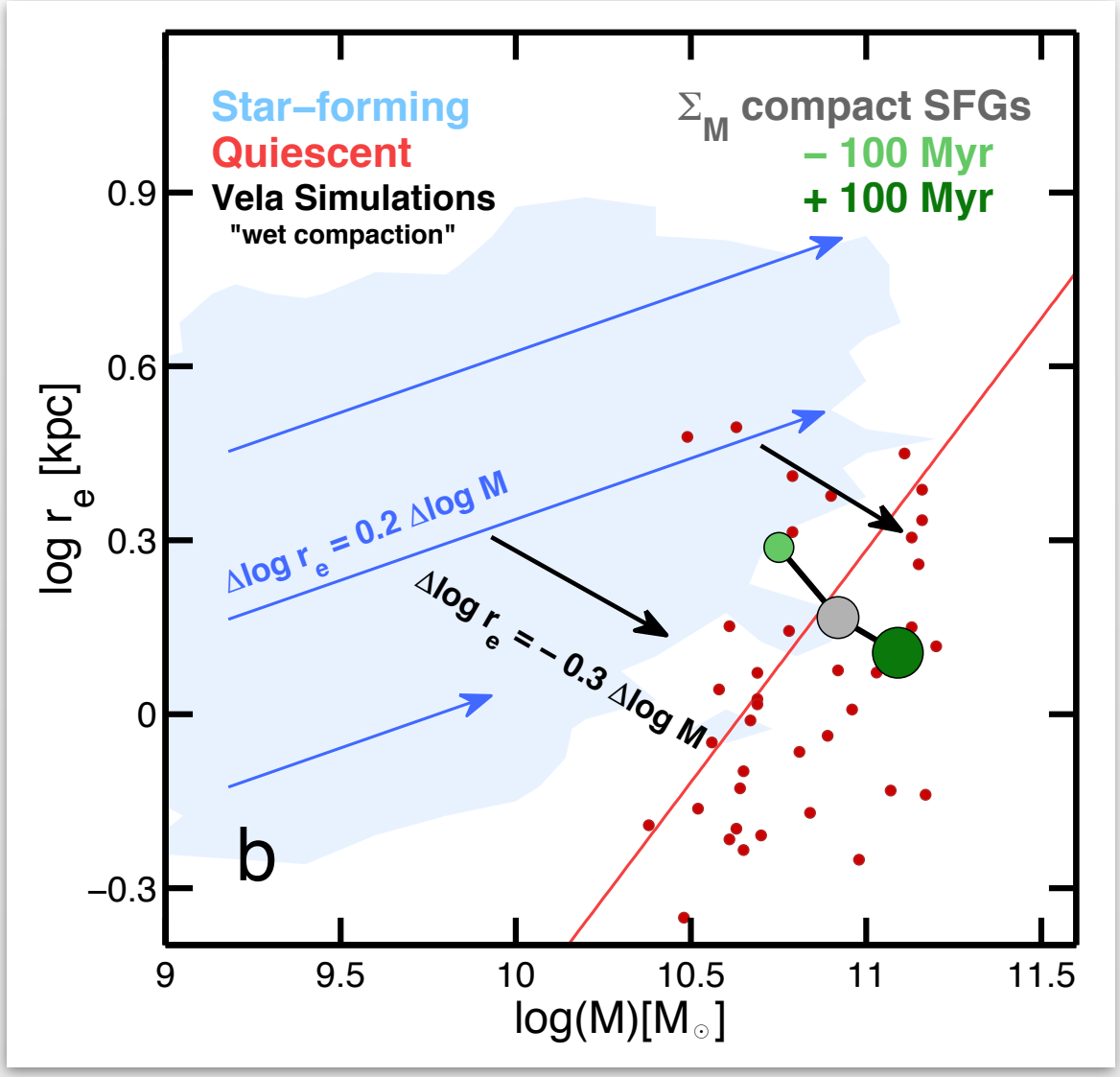
Star formation more concentrated than mass





The formation of dense galactic cores

Barro, Kriek, Perez-Gonzalez et al. (2016)



What about SFHs for different galaxy types?

Zick, Kriek et al. (in prep) - MOSDEF

Embargoed

Stacking MOSFIRE spectra by UVJ color

Zick, Kriek et al. (in prep) - MOSDEF

Embargoed

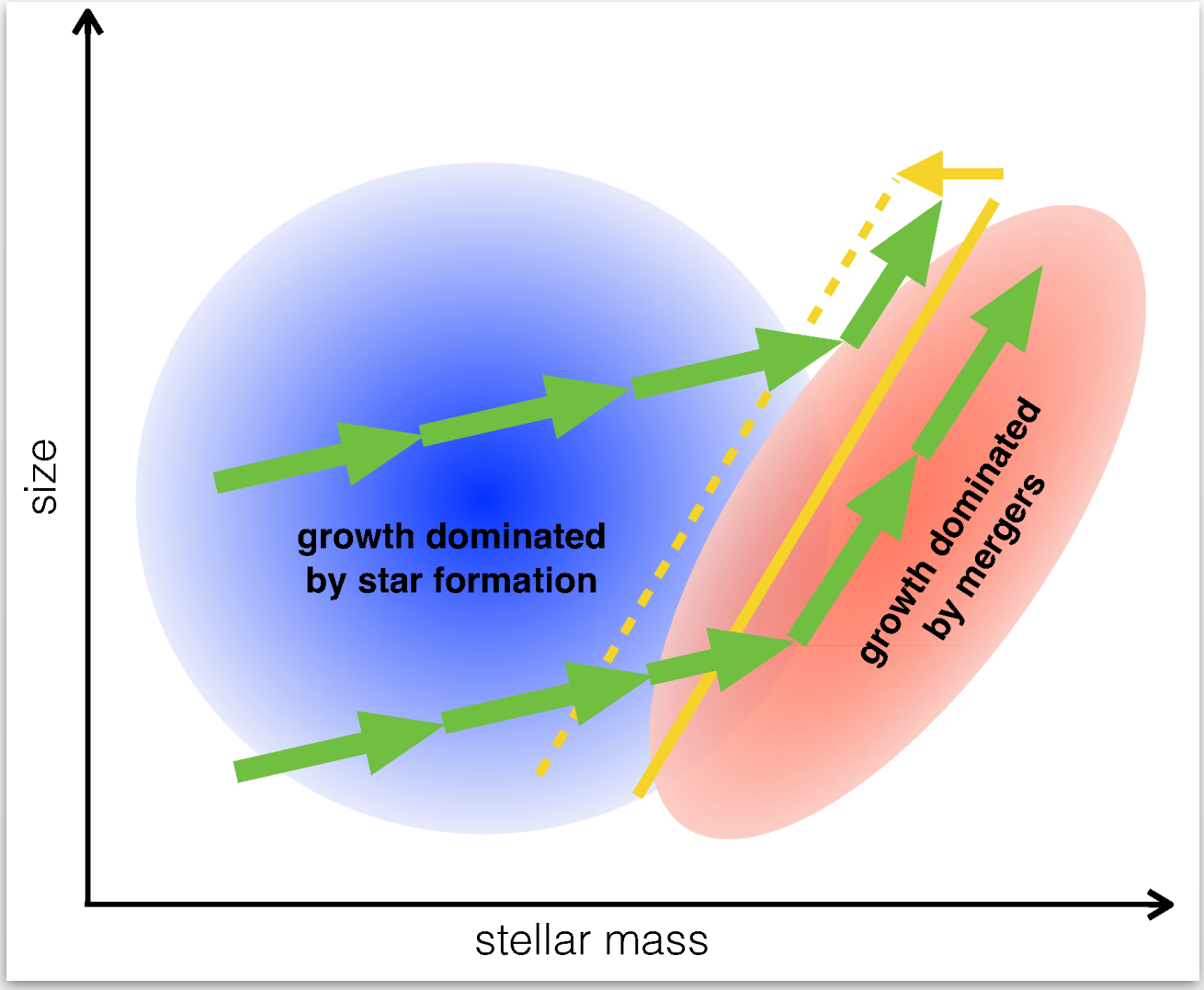
Fast or slow quenching?

Zick, Kriek et al. (in prep)

Embargoed

A simple sketch of massive galaxy growth

van Dokkum et al. (2015)



How well do we actually recover sizes?

Price, Kriek, Feldmann et al. (in prep) - MassiveFIRE, Feldmann et al. (2016)

Embargoed

Recovered light sizes are too large

Price, Kriek, Feldmann et al. (in prep) - MassiveFIRE, Feldmann et al. (2016)

Embargoed

Correction using M/L gradients help

Price, Kriek, Feldmann et al. (in prep) - MassiveFIRE, Feldmann et al. (2016)

Embargoed

Take away points

- Deep continuum spectroscopy provides an undiluted view into the star formation histories of massive galaxies:
  - The most massive galaxies may have formed their stars over a period ~0.2 Gyr with an average past SFR of a few thousand solar masses / yr
  - The resulting extreme abundance pattern will likely be diluted by minor mergers over cosmic time
- Many high-z galaxies transition through a compact phase:
  - z~1.5-2.0 post-starburst galaxies are smaller than both quiescent and star-forming galaxies at similar redshift
  - Compact star-forming galaxies primarily grow their cores
- Beware though: size measurements, in particular from just light suffer from systematic uncertainties, which may differ per galaxy type