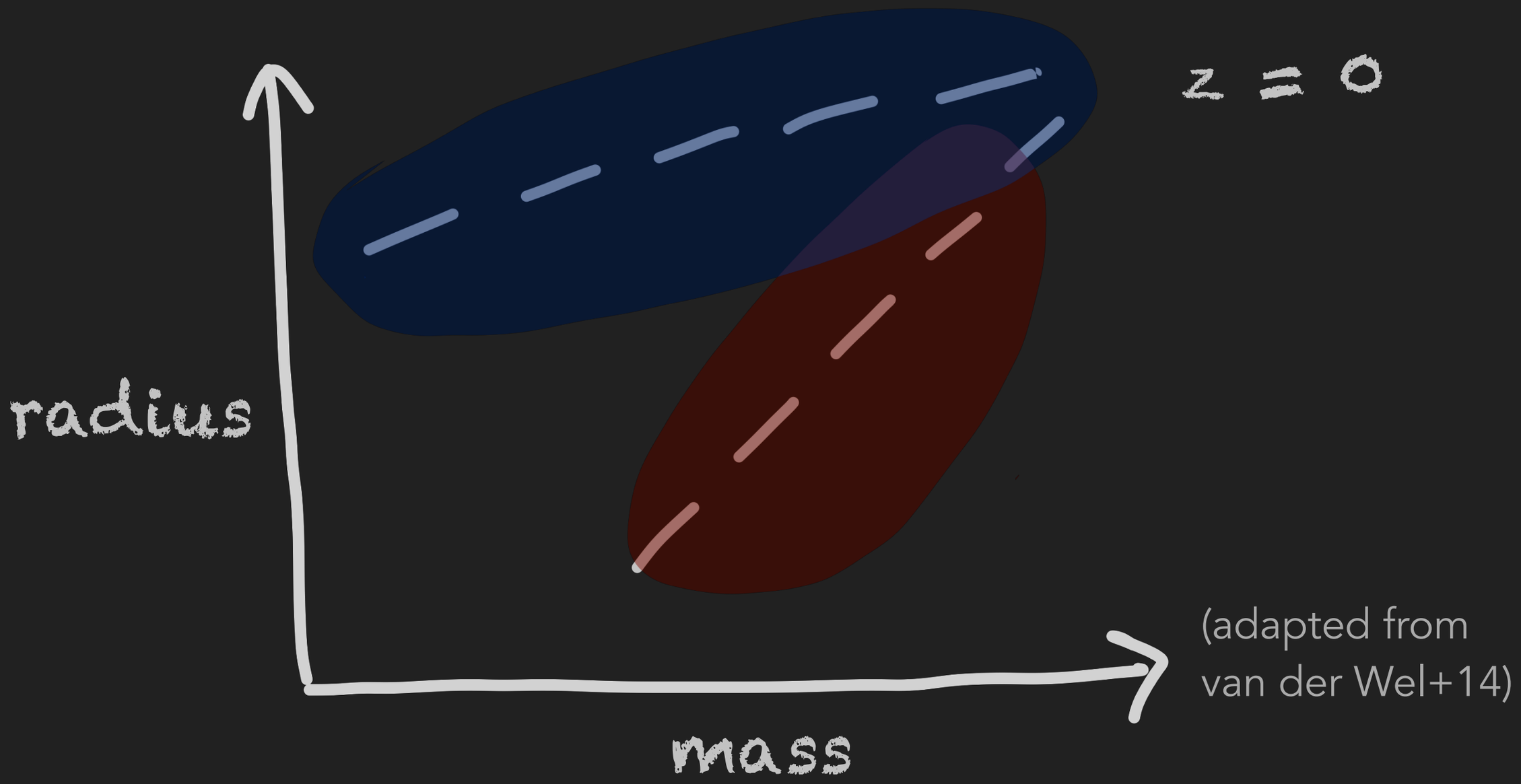
COLOR GRADIENTS are responsible for most of the evolution in the mass-size relation

Katherine (Wren) Suess— UC Berkeley

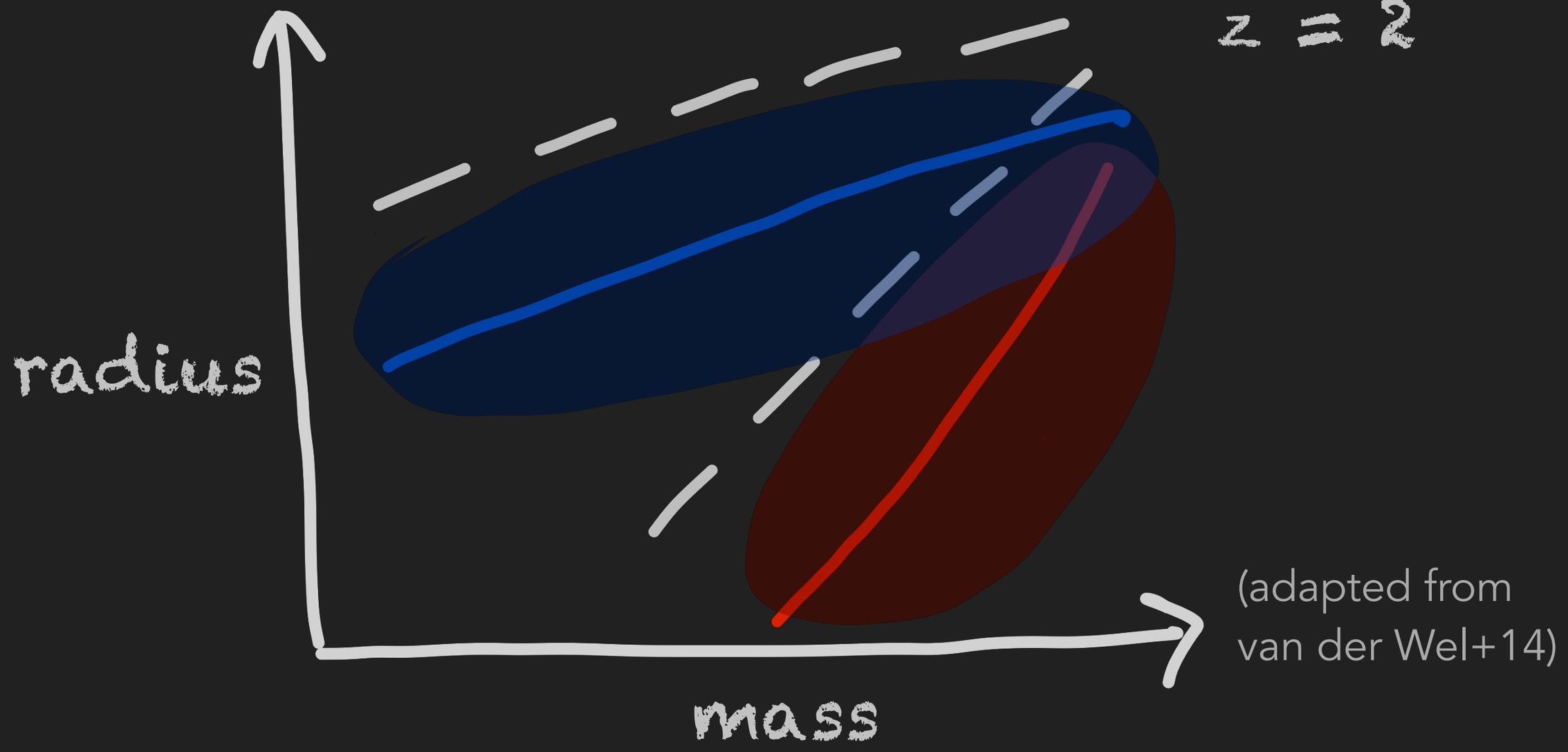
with Mariska Kriek, Sedona Price, & Guillermo Barro

GALAXY SIZES & MASSES ARE RELATED



(adapted from
van der Wel+14)

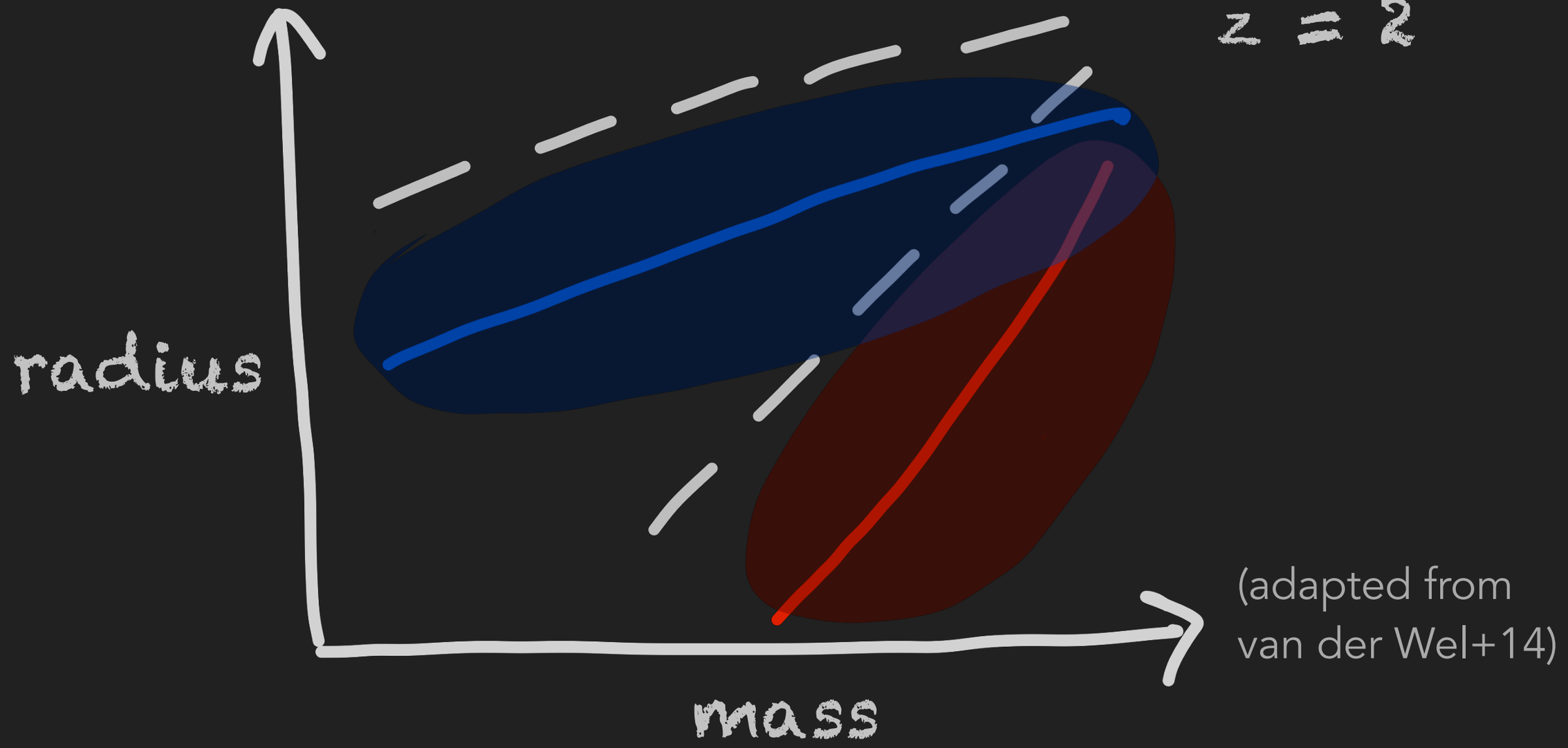
GALAXY SIZES & MASSES ARE RELATED



quiescent galaxies seem to have experienced remarkable size growth over cosmic time

(Daddi+05, van Dokkum+08, Damjanov+09, Szomoru+10, Damjanov+11, van der Wel+14)

GALAXY SIZES & MASSES ARE RELATED



inside-out growth?

Bezanson+09, Naab+09,
Hopkins+09, van de Sande+13

progenitor bias?

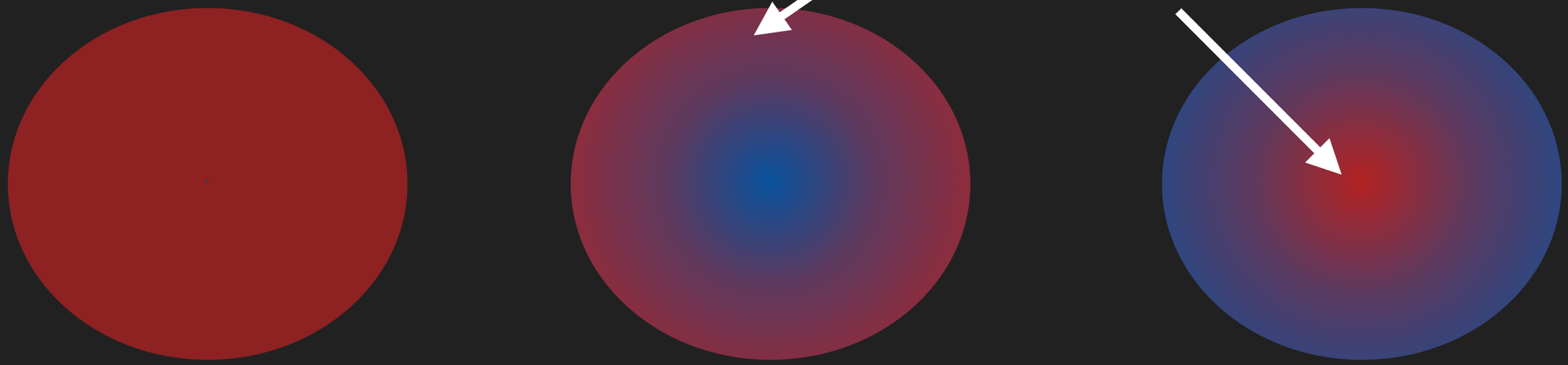
van Dokkum & Franx 01,
Carollo+13, Poggianti+13

GALAXY HALF-MASS RADII:

light is a *biased tracer* of mass.

radial variations in **stellar population properties**

create *M/L* gradients



flat *M/L*:

$r_{e,mass} = r_{e,light}$

increasing *M/L*:

$r_{e,mass} > r_{e,light}$

decreasing *M/L*:

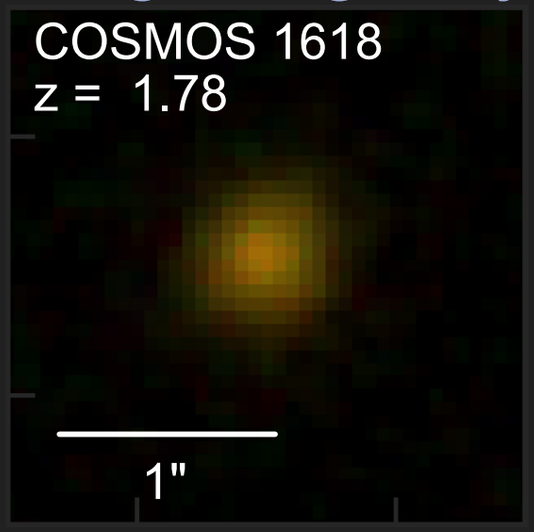
$r_{e,mass} < r_{e,light}$

THE SAMPLE:

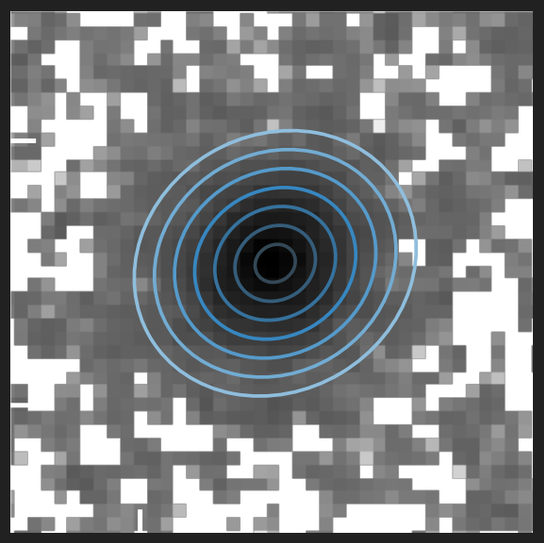
- ~7,000 1.0 < z < 2.5 galaxies with ZFOURGE photometry (Straatman+16, **Suess+19a**)
- plus ~9,500 z < 1.0 galaxies **(Suess+19b)**
- all have high-resolution *HST* imaging from CANDELS (Grogin+11, Koekemoer+11, Brammer+12, Momcheva+16, Skelton+14)

MEASURING *M/L* GRADIENTS:

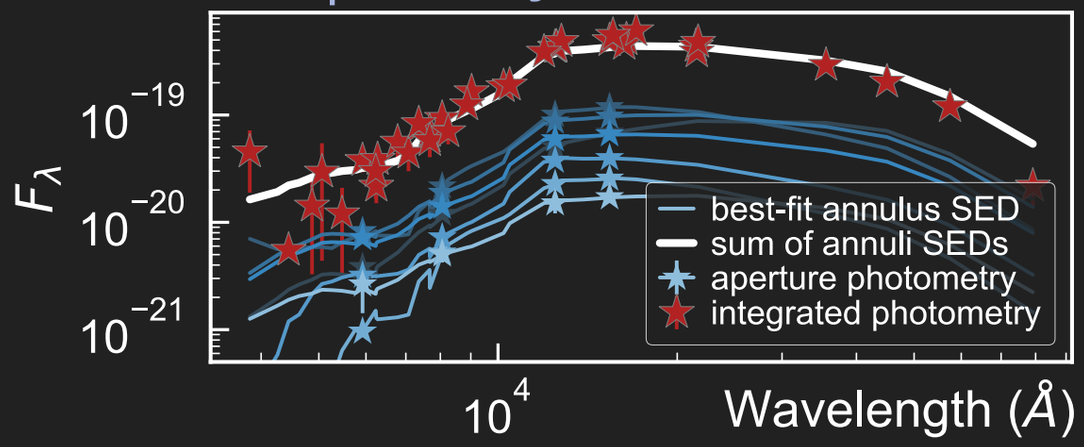
1. start with color image of galaxy



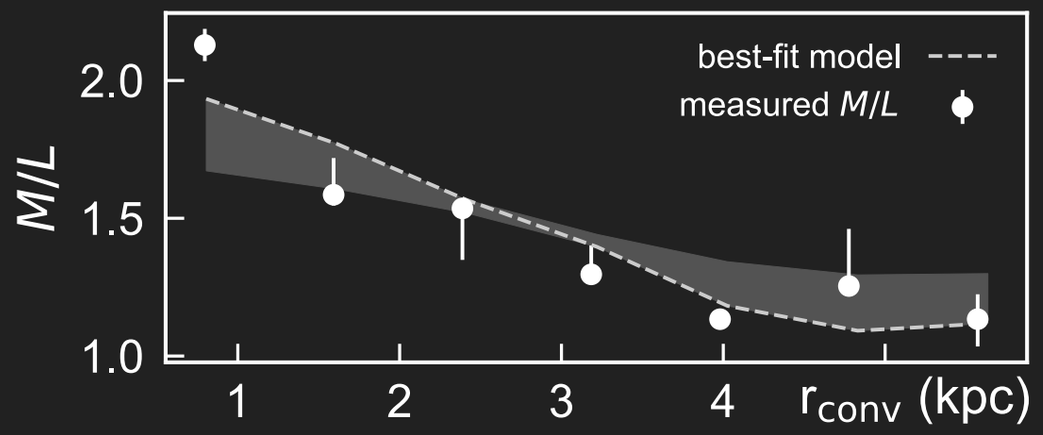
2. measure aperture photometry



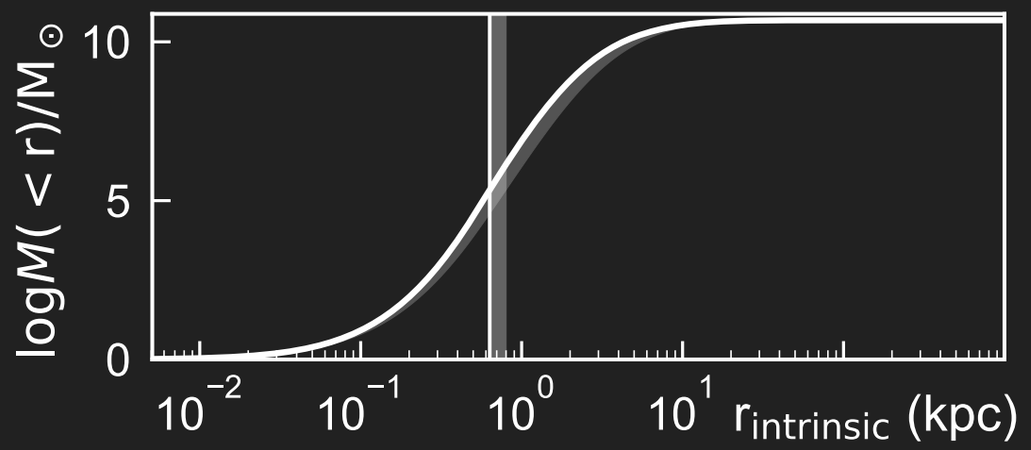
3. fit spatially-resolved SEDs



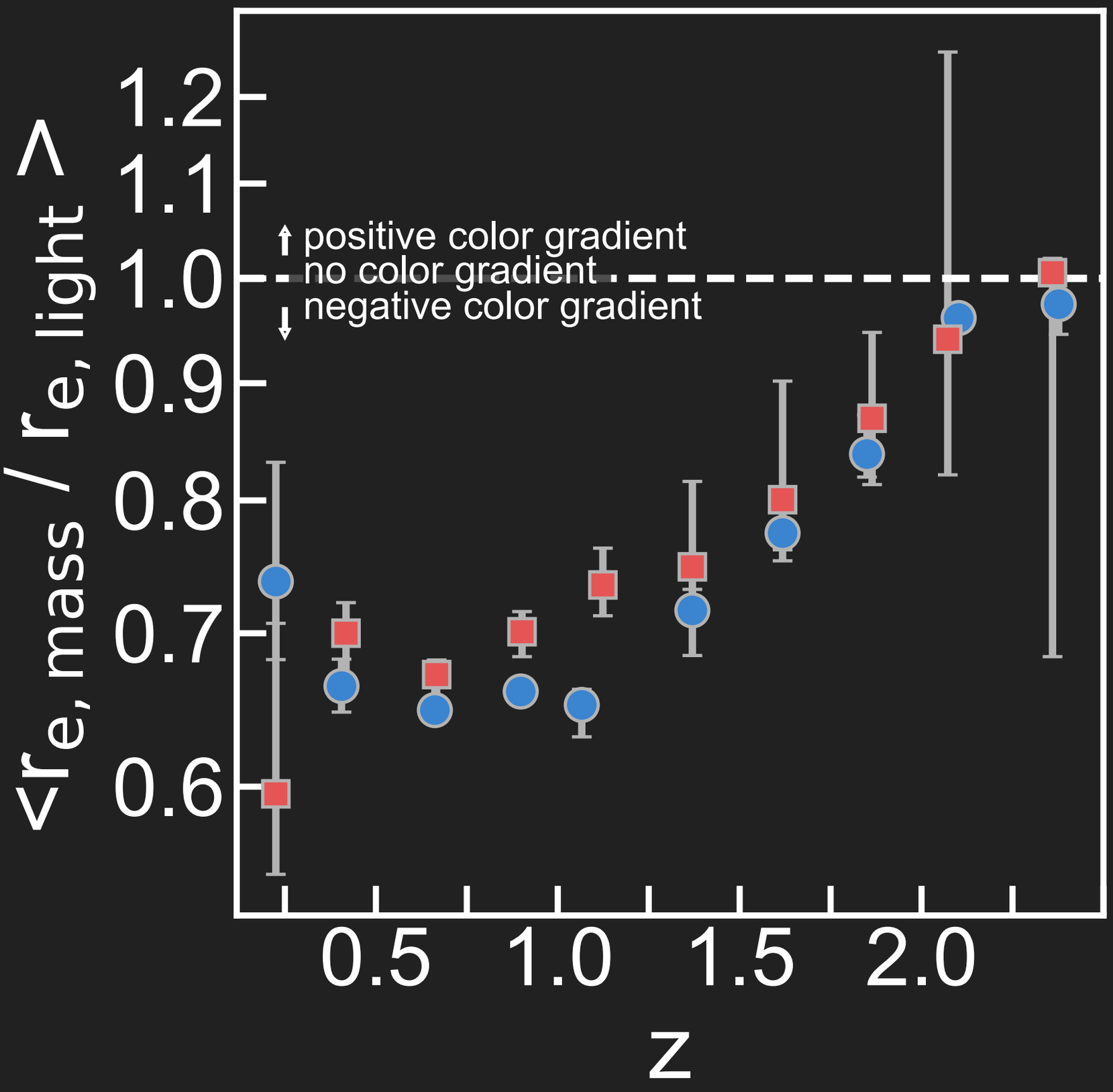
4. model intrinsic *M/L* profile



5. get mass profile



COLOR GRADIENTS EVOLVE WITH REDSHIFT

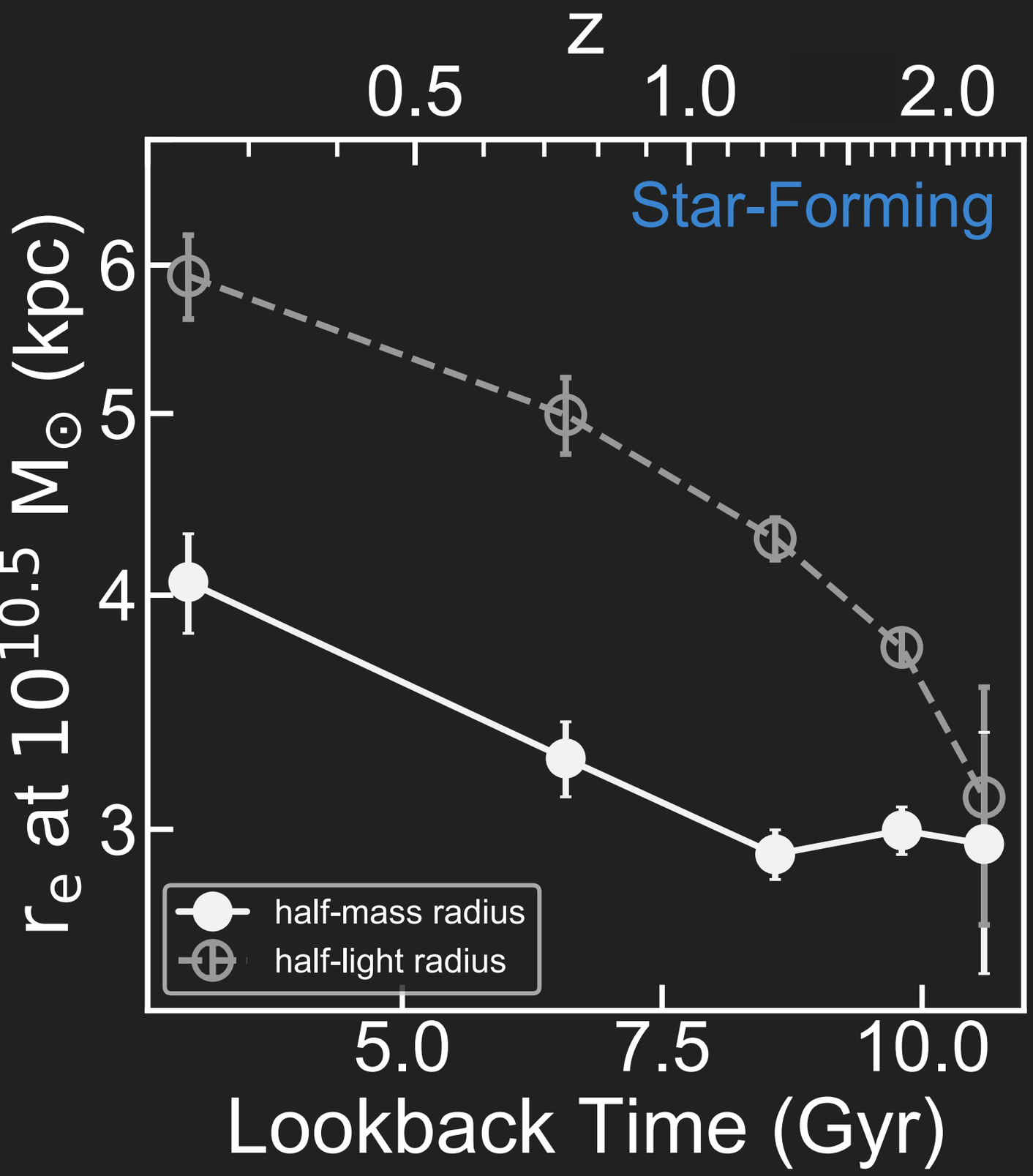


half-mass radii have a different redshift evolution than half-light radii!

this changes the mass-size relation.

Suess+19a,b

THE GROWTH OF STAR-FORMING GALAXIES

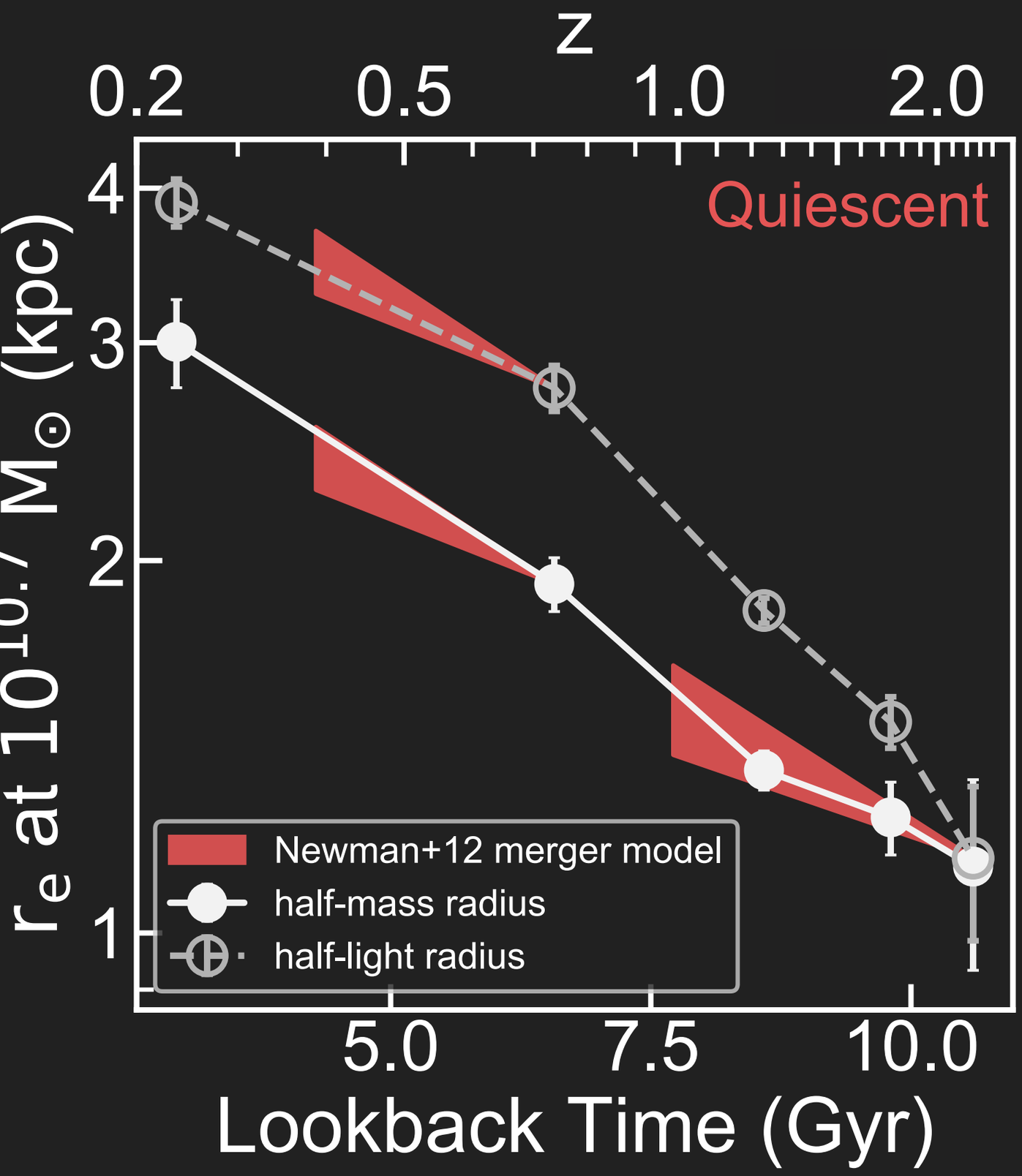


star-forming galaxies grow much slower—in tension with simulations.

Suess+19a,b

(r_{light}-M fits from Mowla+18)

THE GROWTH OF QUIESCENT GALAXIES



half-mass radius growth of quiescent galaxies is fully consistent with minor merger growth model

Suess+19a,b

(r_{light}-M fits from Mowla+18)

CAN WE MOVE BEYOND RED VS. BLUE?

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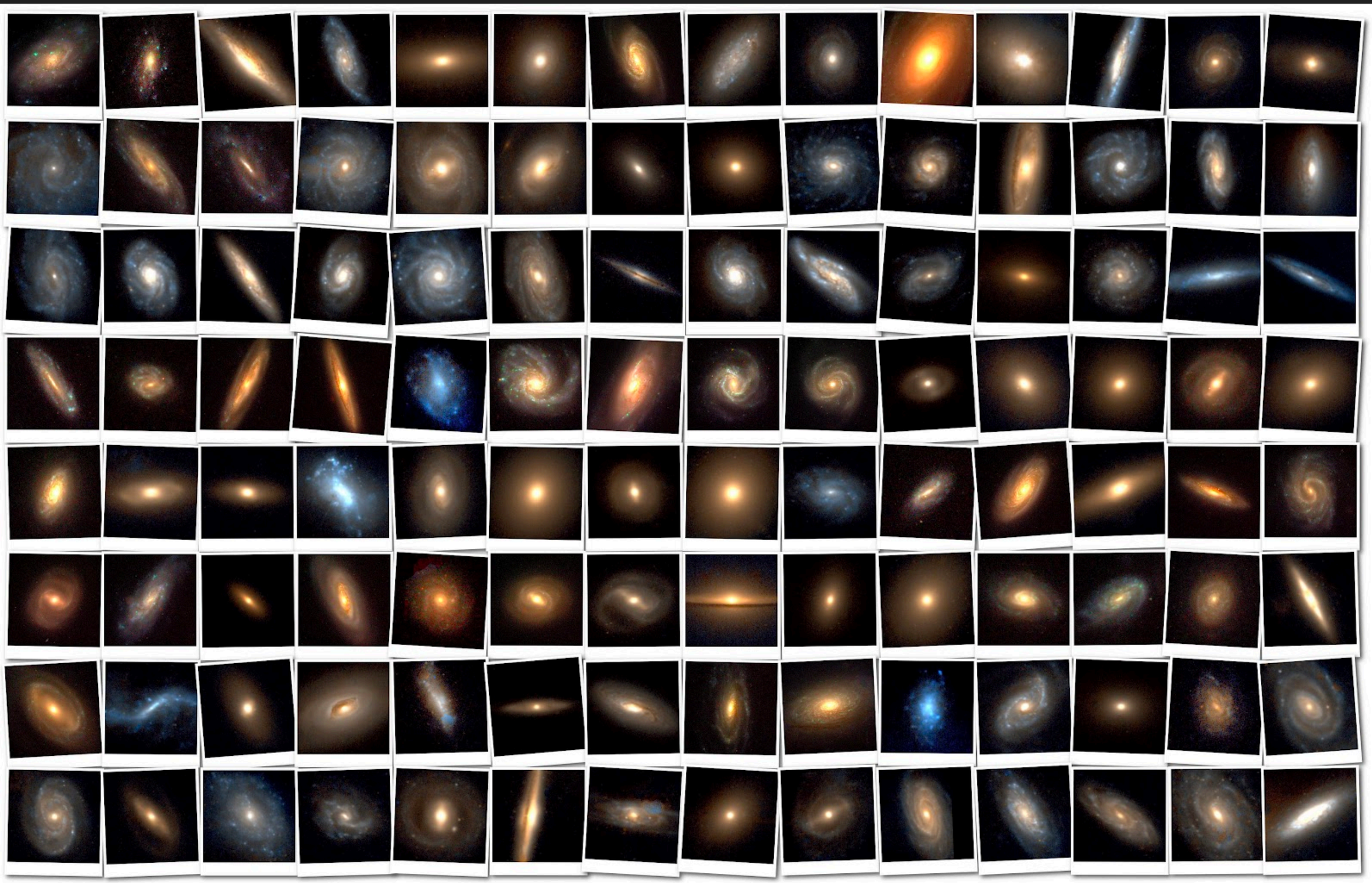
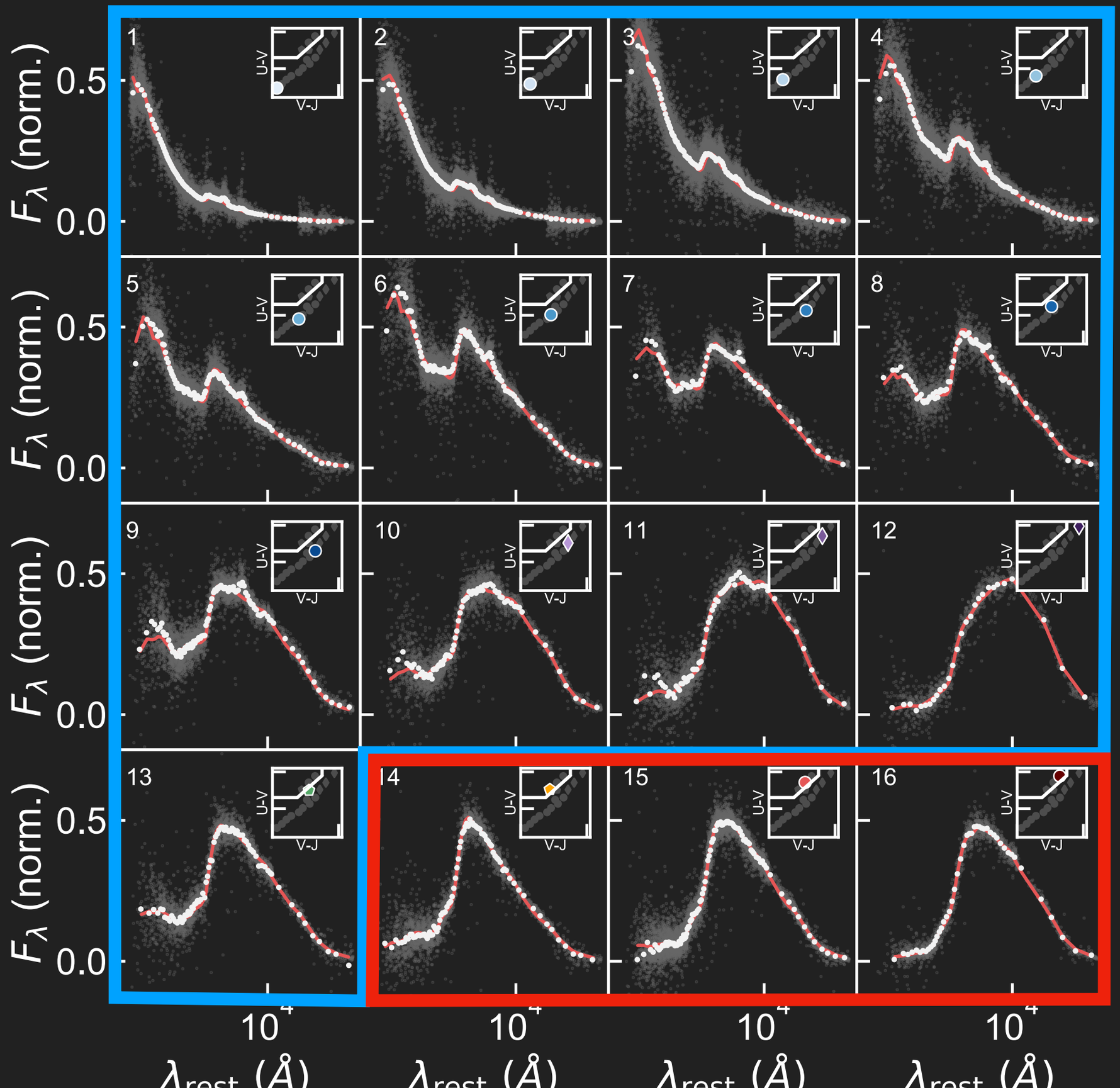


Created by Zsolt Frei and James E. Gunn

CLASSIFYING GALAXIES BY SED SHAPE



individual galaxies

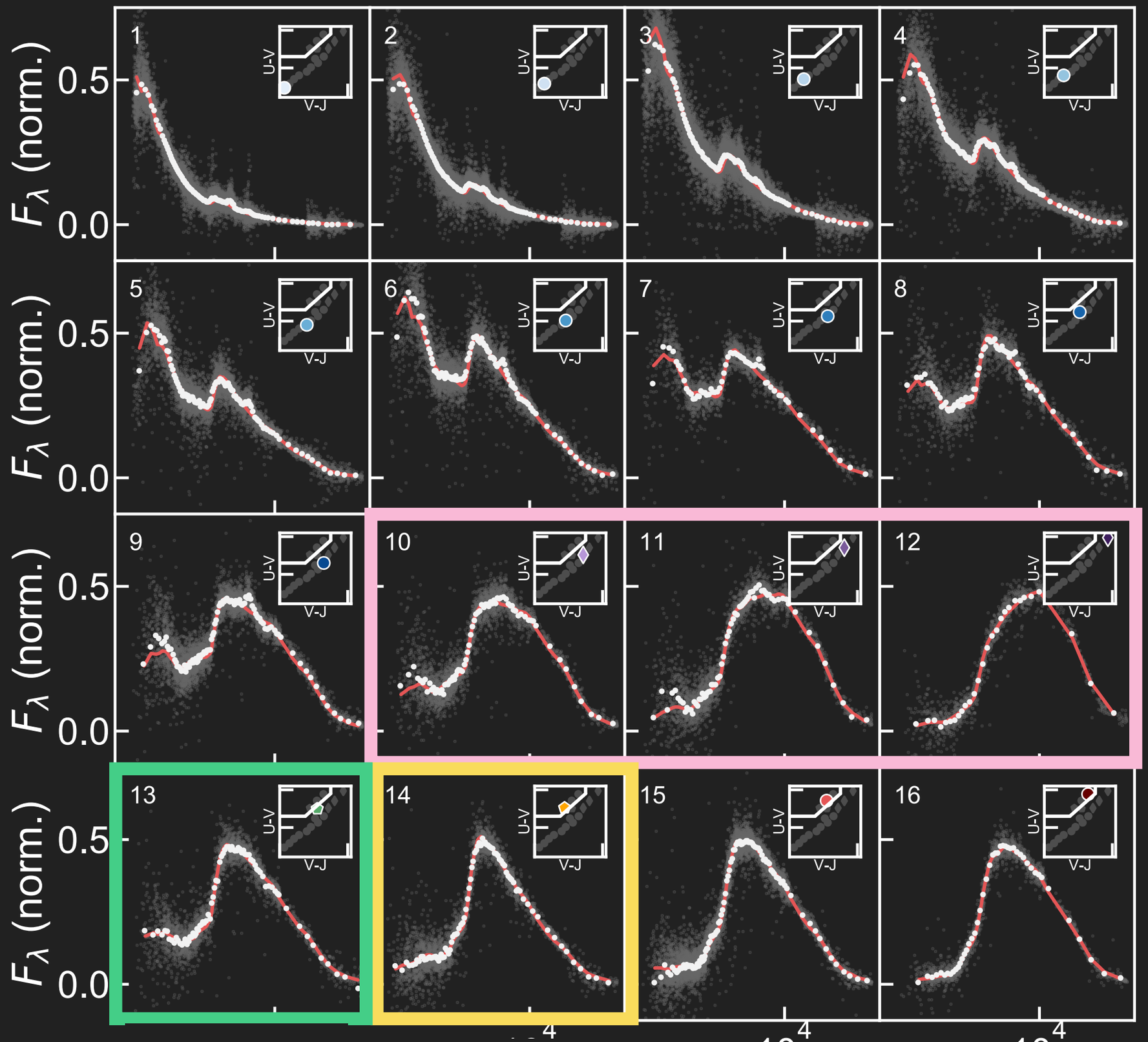
composite SED

best-fit model

Suess+ in prep

(method based on Kriek+11)

CLASSIFYING GALAXIES BY SED SHAPE



individual galaxies

composite SED

best-fit model

dusty star-formers

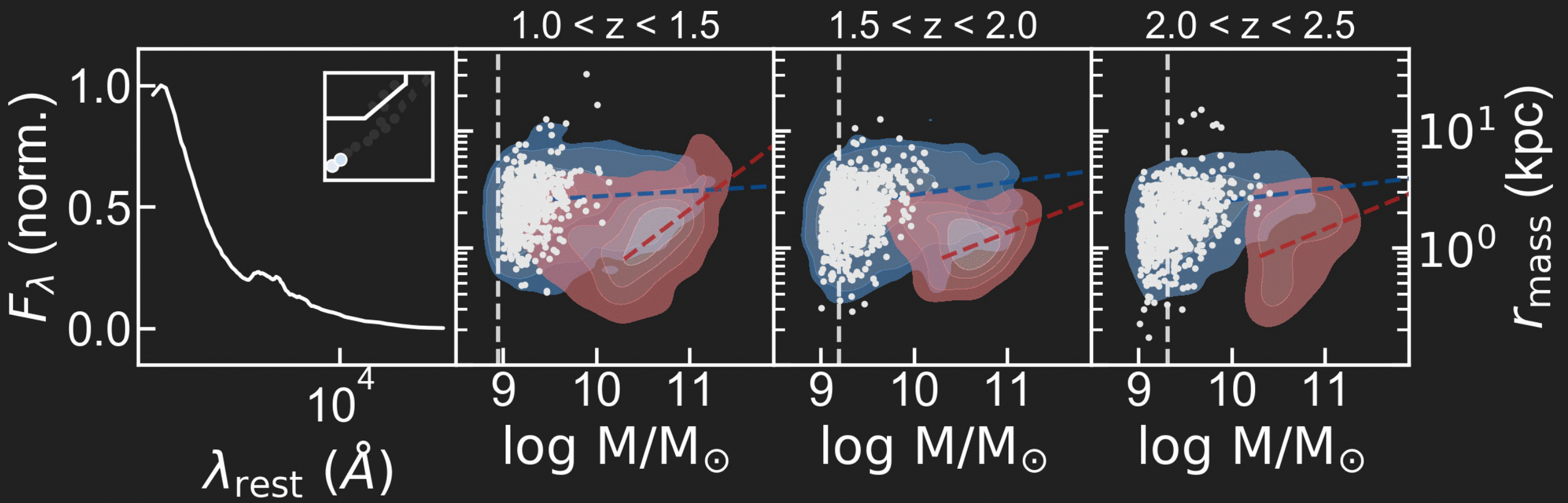
green valley

post-starburst

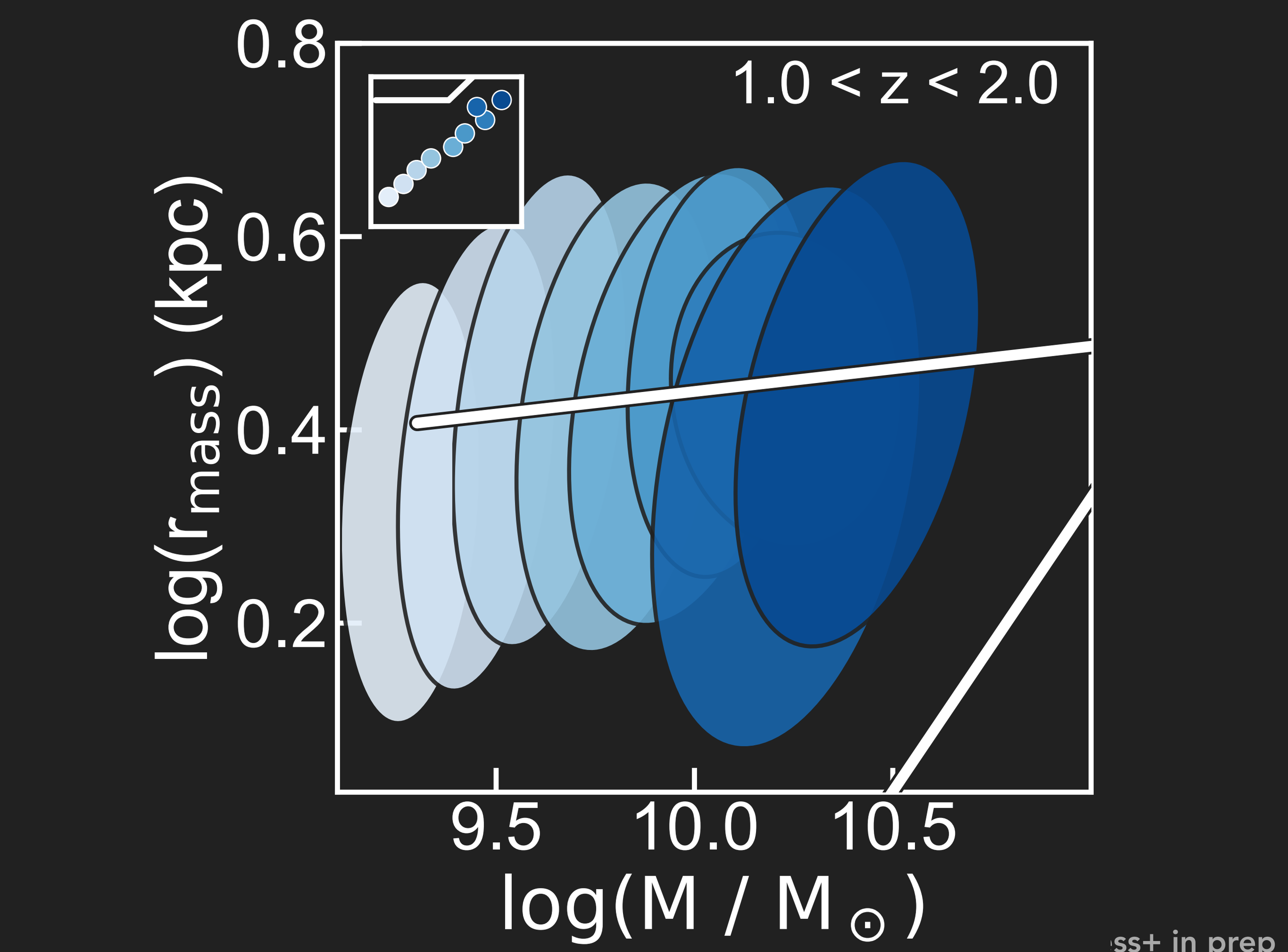
Suess+ in prep

(method based on Kriek+11)

GROUPS LIE IN DISTINCT PARTS OF MASS-SIZE SPACE



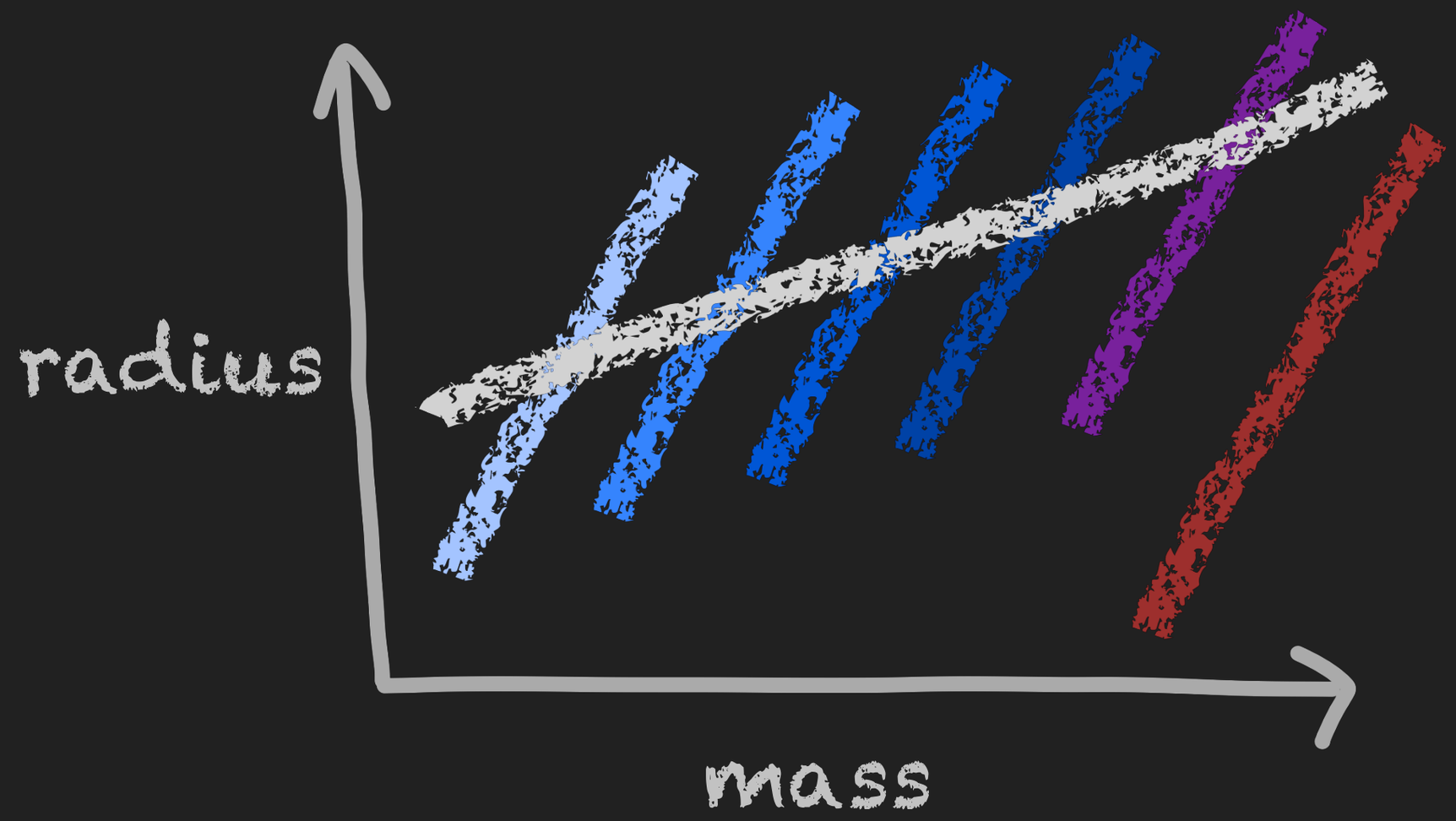
Suess+ in prep



ss+ in prep

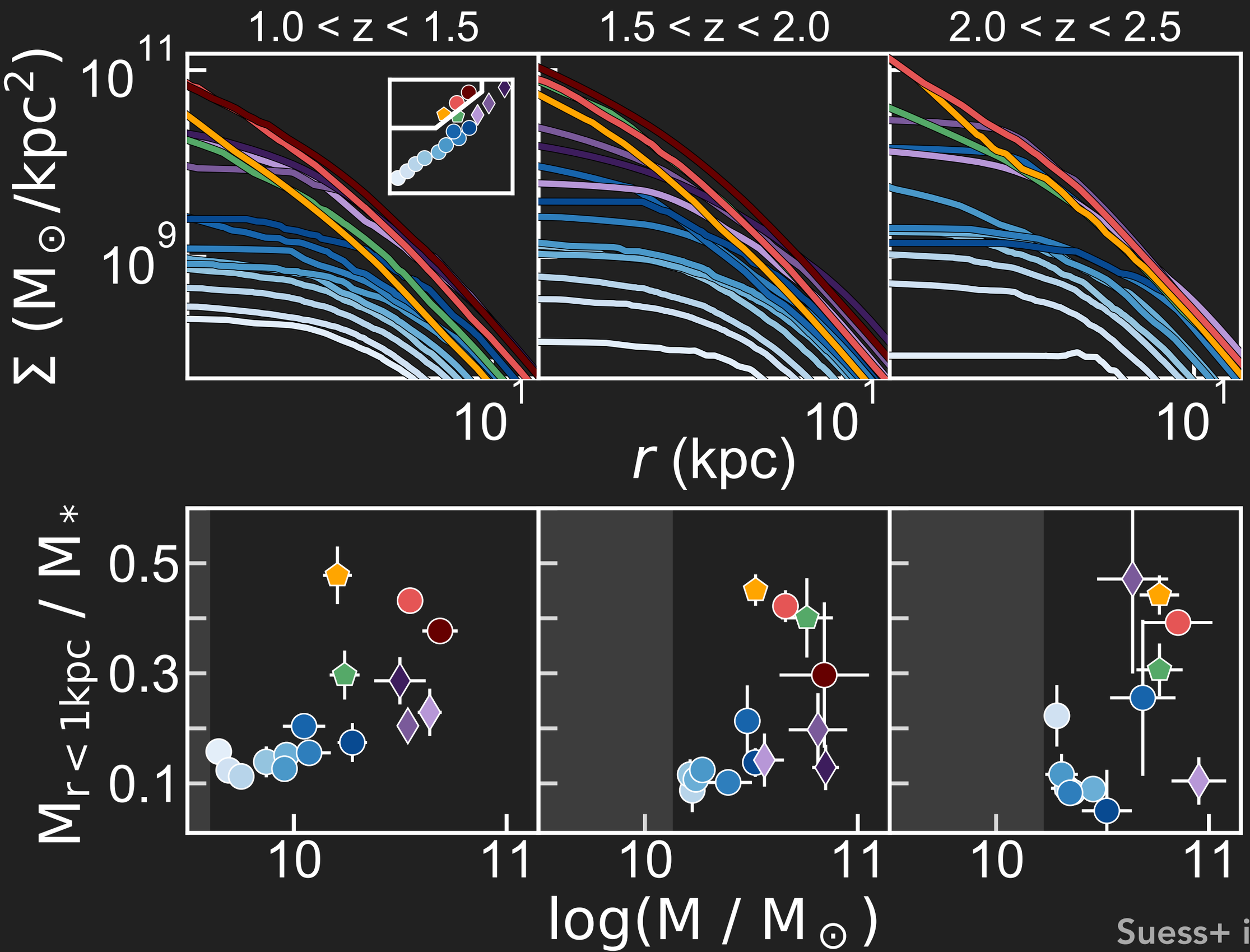
THE SHALLOW SLOPE OF THE STAR-FORMING RELATION MAY BE AN ARTIFACT

- what sets the “initial slope” ?
- what sets the “evolutionary slope” ? (van Dokkum+15)



Suess+ in prep

CORE MASSES GROW ALONG WITH GALAXIES



Suess+ in prep

TAKE-AWAY POINTS

- need to take color gradients into account when measuring galaxy sizes!
- the rapid growth of quiescent galaxies from z~2.5 to z~0 isn't as rapid as we thought
  - fully consistent with minor merger growth model!
- new way to view the star-forming mass-size relation: many parallel relations