

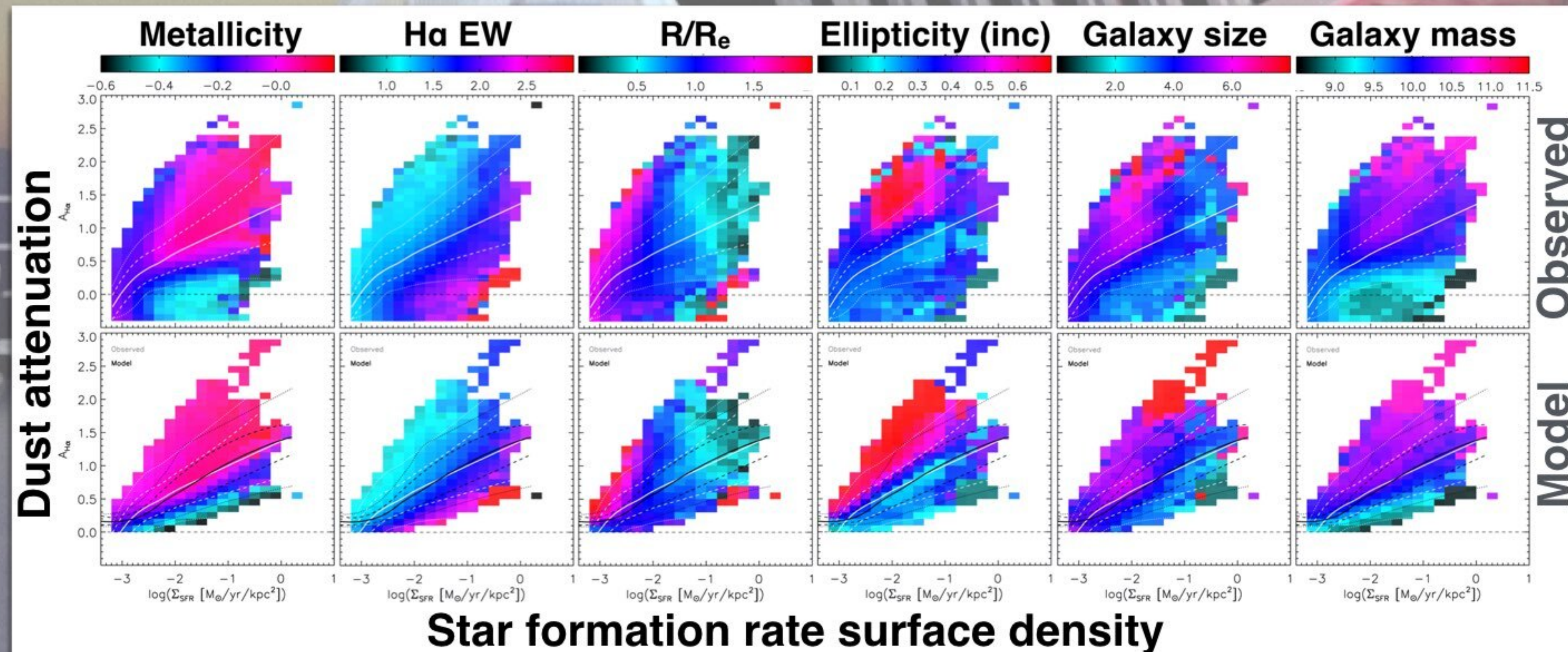
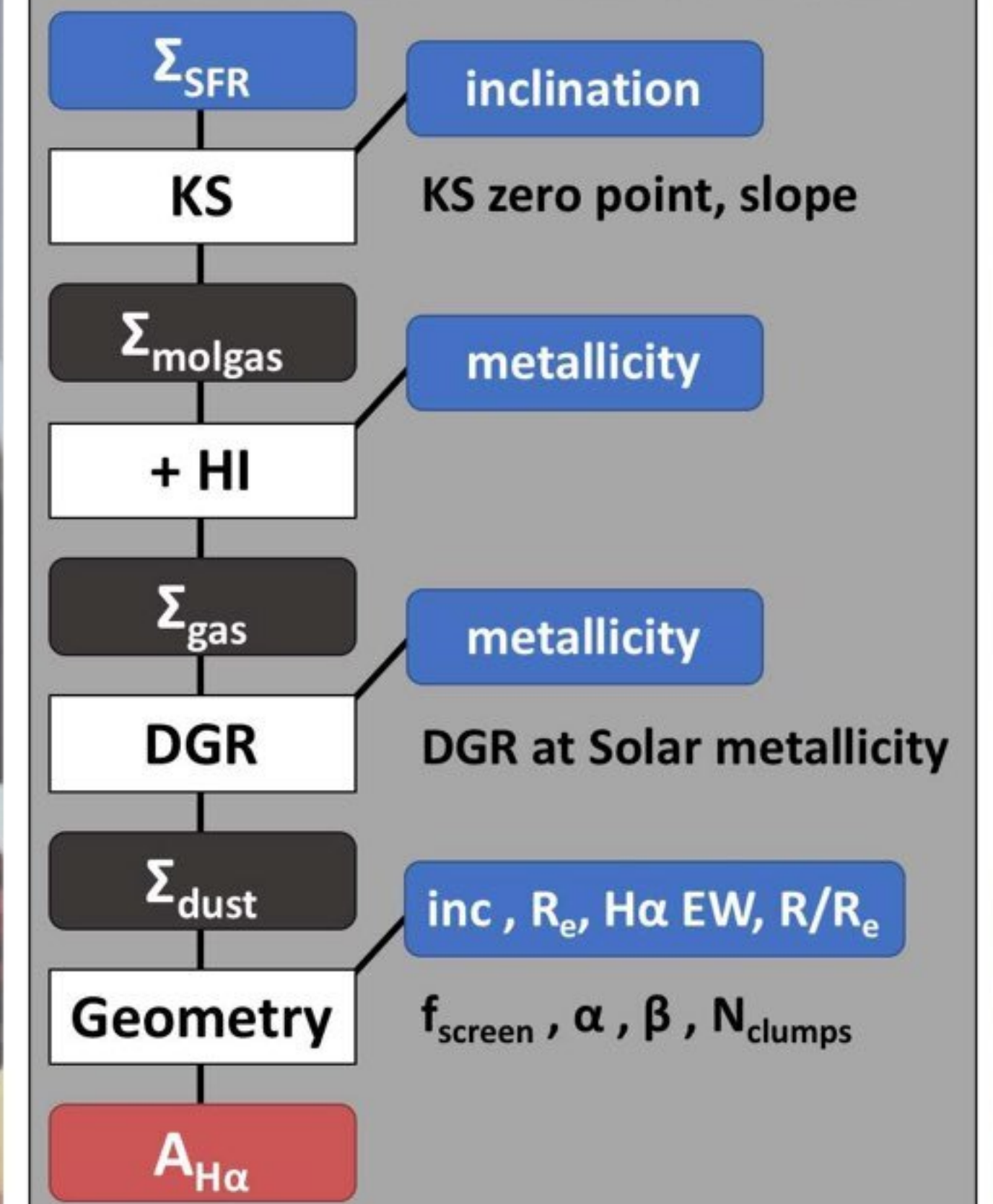
Resolving star formation across cosmic time

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MaNGA

The star formation - extinction relation within nearby galaxies

The Star Formation – Extinction Relation



The relation between local star formation activity and dust attenuation, as well as its secondary dependencies on local and global galaxy properties, can be reproduced by a **superlinear Kennicutt-Schmidt** relation, a **dust-to-gas ratio scaling linearly with metallicity** and a **clumpy dust geometry**.

Simpler dust geometries fail, and inclination dependencies need to be accounted for.

Li, Wuyts+2019

$z \sim 1$

3D-HST vs IllustrisTNG

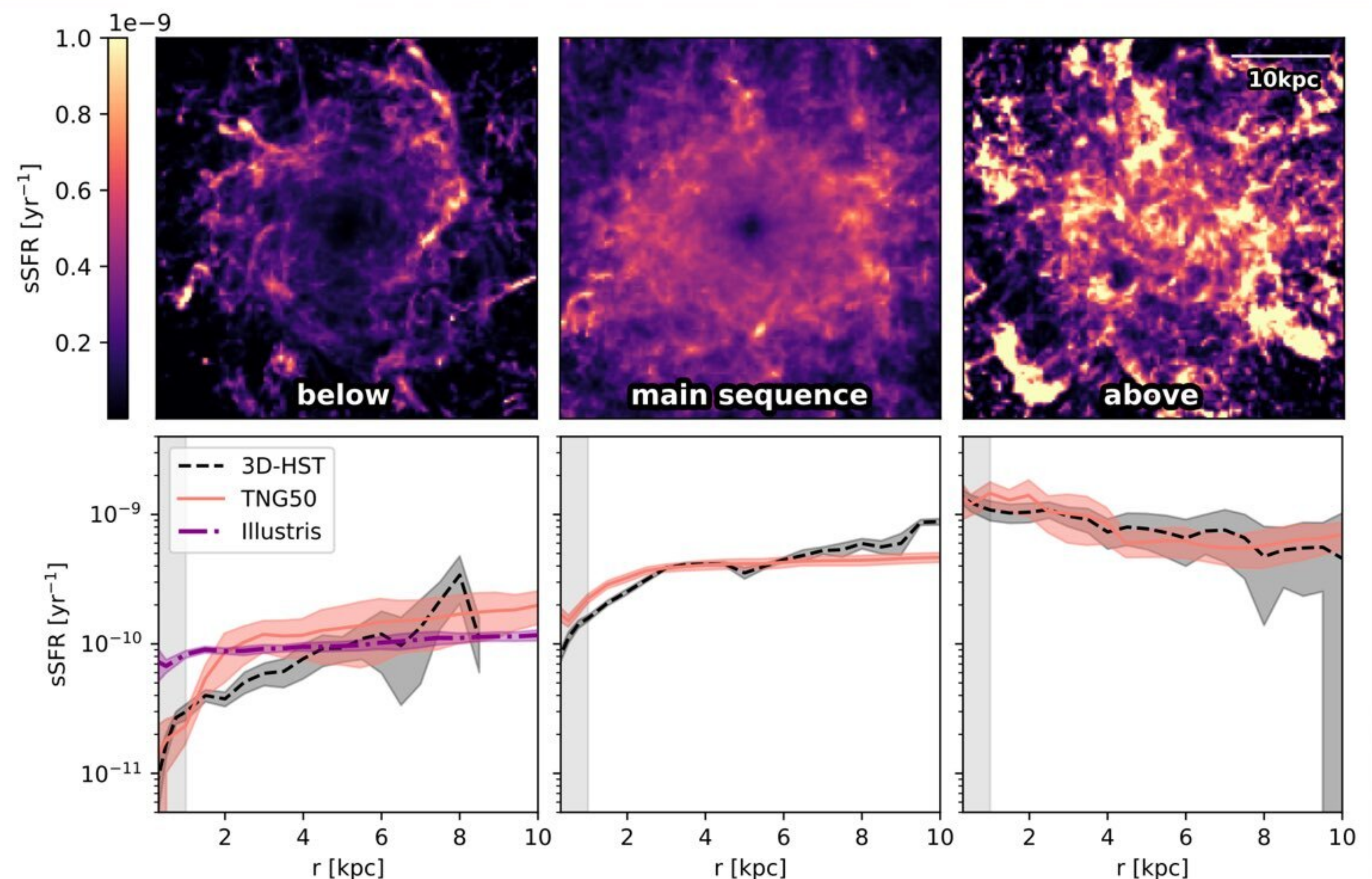
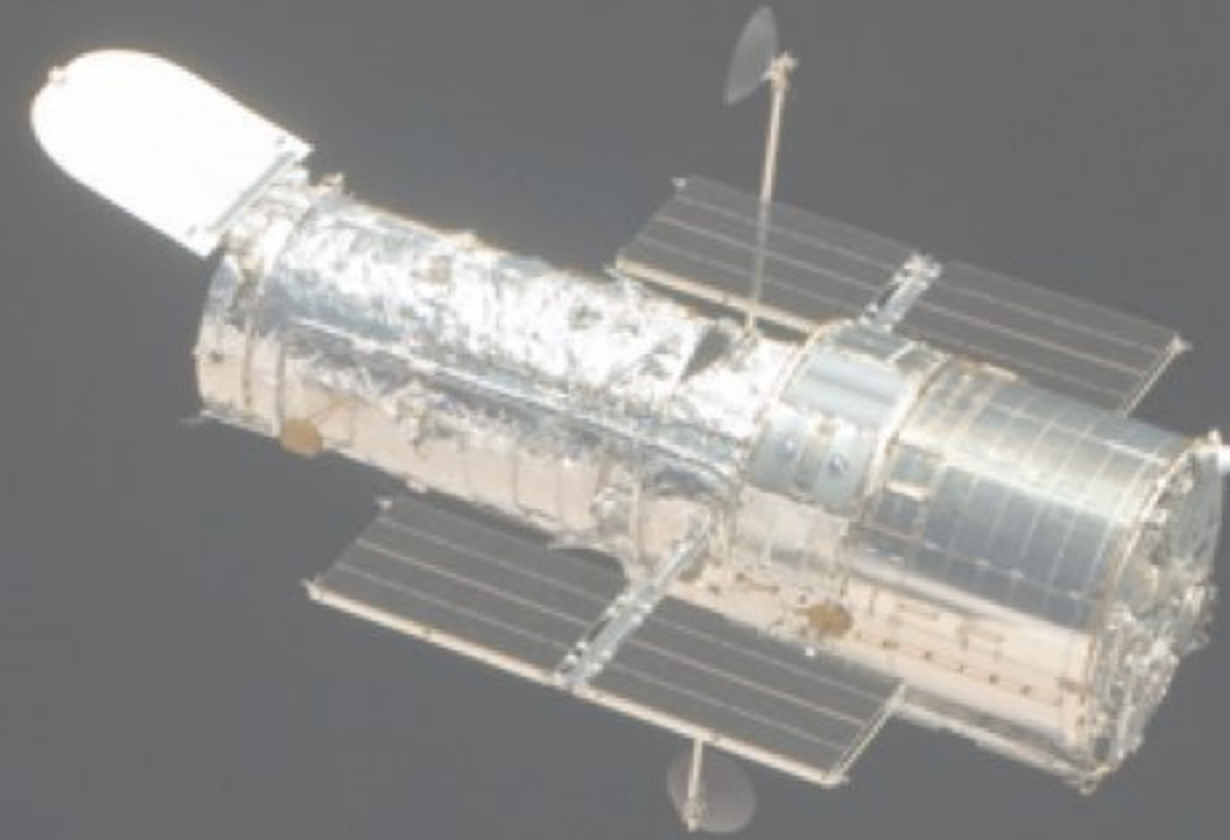
HST grism observations allow the extraction of H α maps as a tracer of instantaneous star formation on kpc scales within star-forming galaxies (SFGs) at $0.7 < z < 1.5$.

Dividing SFGs with stellar mass $\log(M^*) = 10.5 - 11$ into those lying above/on/below the star-forming main sequence (MS), we find an overall shift in normalization of their specific star formation rate ($sSFR \equiv \Sigma_{SFR}/\Sigma^*$) profiles. I.e., **above-MS galaxies** feature **excess star formation at all radii**.

The largest differences in $sSFR$ are seen in the galaxy centres, where **below-MS SFGs** reveal the onset of **inside-out quenching**.

The **TNG50** simulation reproduces these trends remarkably well. Critically, this is no longer the case in a (smaller box) 'TNG variation' run where the **AGN kinetic wind model** is switched off.

Nelson+2021

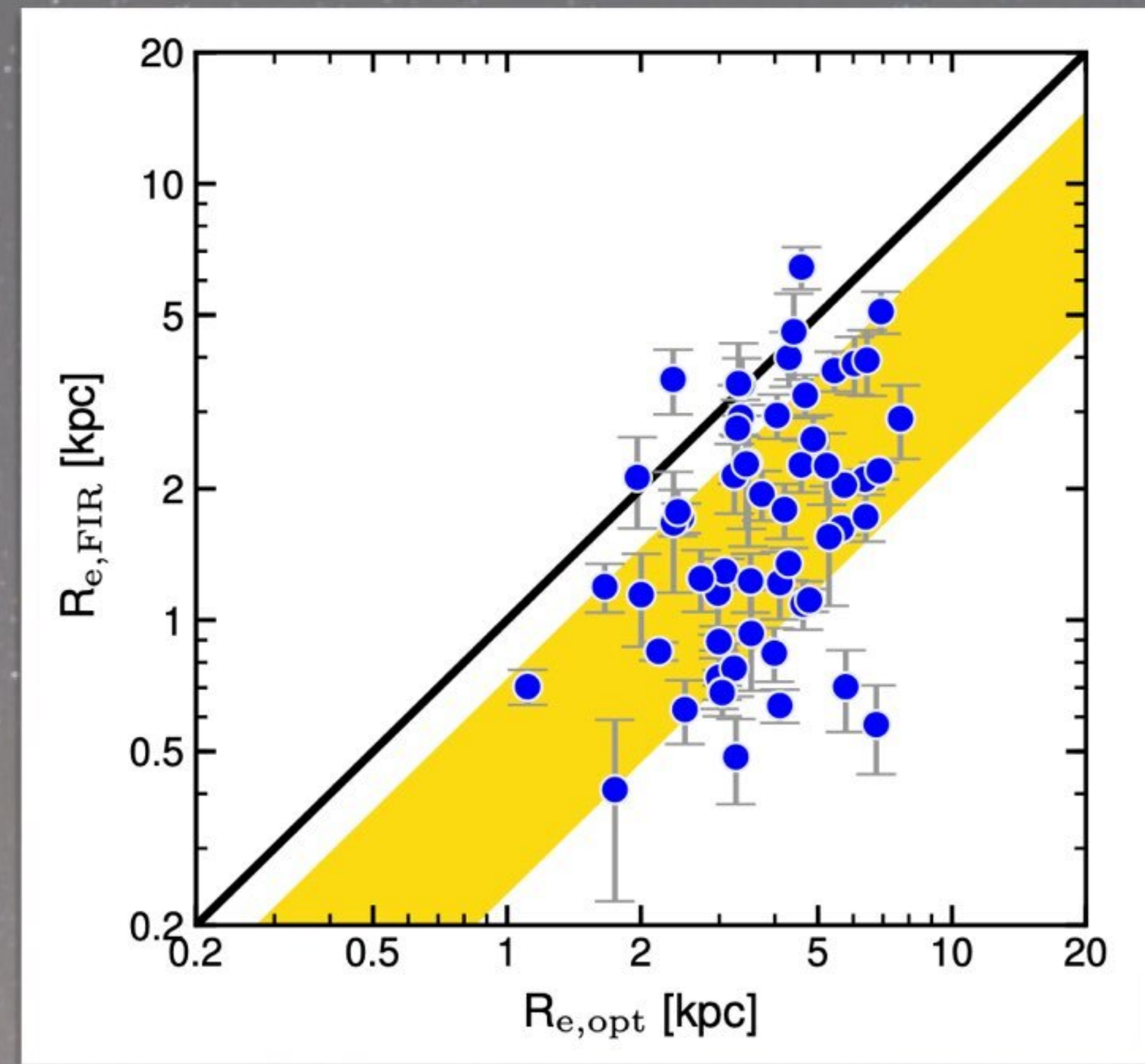
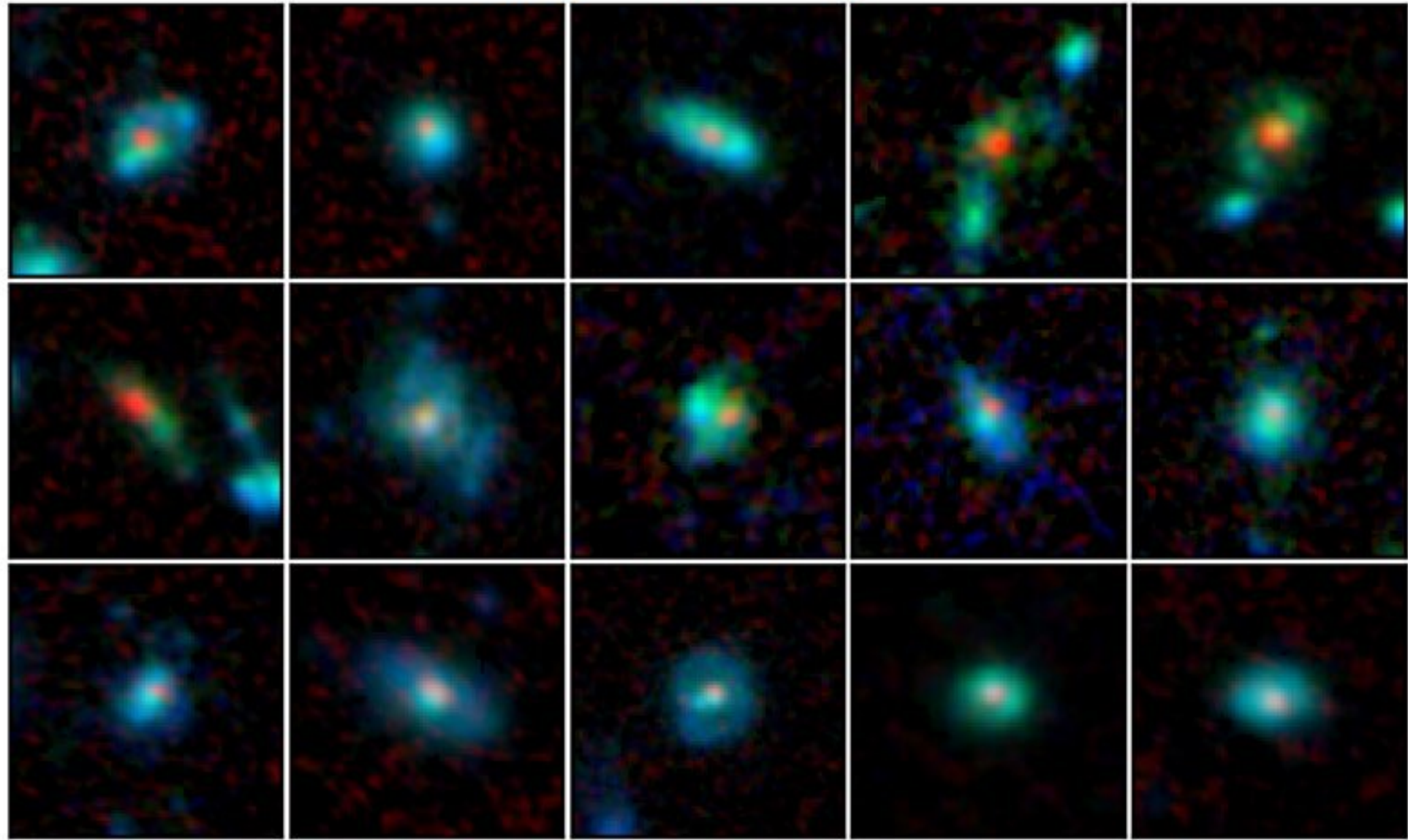


$z \sim 2$

$\log(M_*) > 11$

Far-IR dust continuum

J₁₂₅H₁₆₀870 μ m



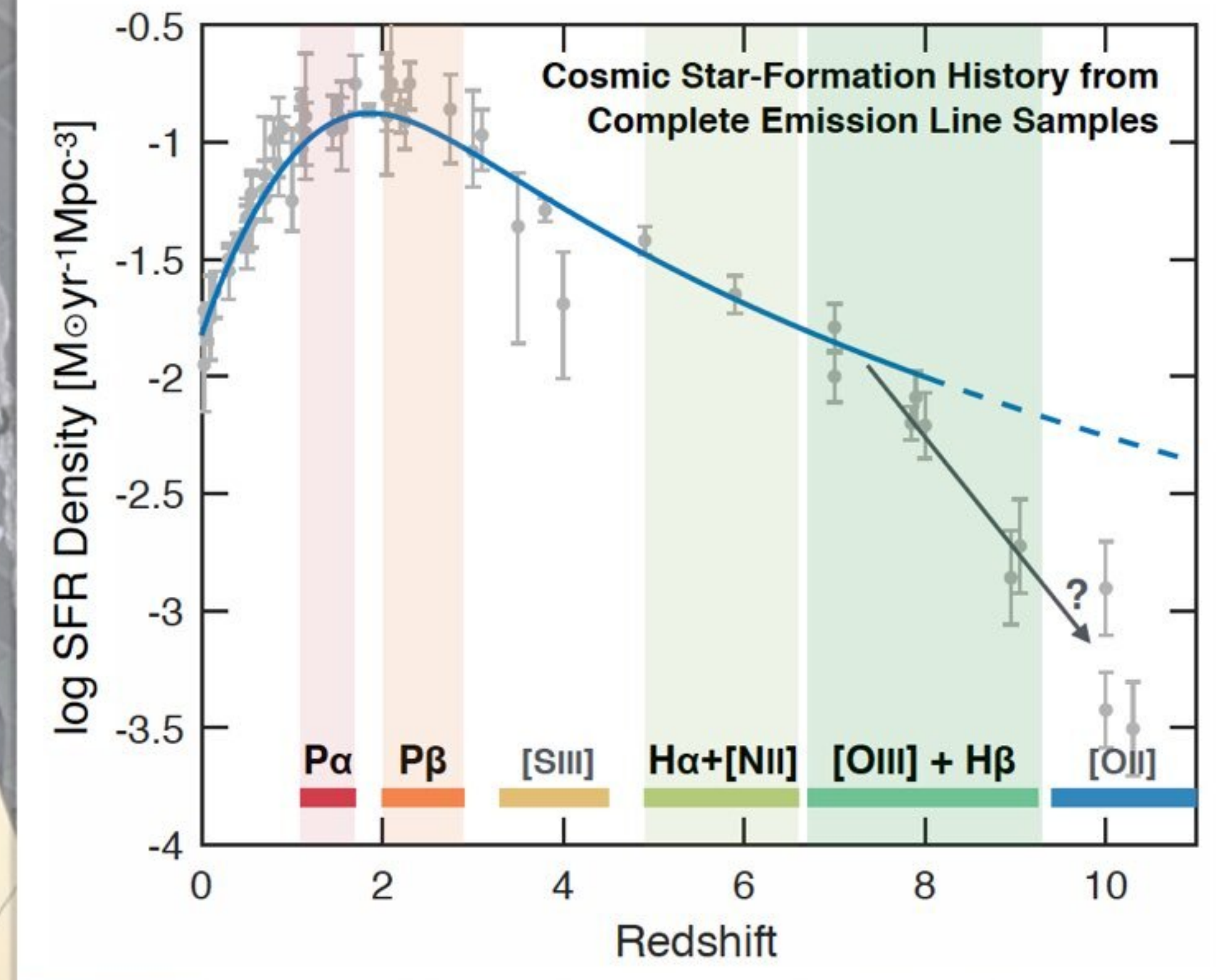
0.2"-resolution ALMA observations reveal **compact dusty cores** within a mass-selected sample of star-forming galaxies at $z \sim 2$. The 870 μ m dust continuum sizes are 2.3x smaller than those measured in the rest-frame optical for the same galaxies, and 1.9x smaller than those measured on stellar mass maps reconstructed from multi-band HST imaging.

This suggests we are witnessing the **rapid formation of a bulge** component. The compact starburst puts most massive star-forming galaxies on the mass-size relation for quiescent $z \sim 2$ galaxies within 300Myr, if the current star formation activity and its spatial distribution are maintained.

Tadaki+2017, 2020

FRESCO

From cosmic noon
into the epoch of
reionization



FRESCO is a **JWST Cycle 1 NIRCam/grism** programme that in 2-hr deep observations with the **F444W** filter will obtain spectroscopic redshifts for highly complete samples of line-emitting galaxies in the **CANDELS-Deep** fields from cosmic dawn to cosmic noon.

High-resolution **Balmer line maps** will probe the spatial extent of instantaneous star formation well **into the epoch of reionization**.

At **cosmic noon**, **Paschen line profiles** will yield a **less dust sensitive** probe of ongoing star formation.

PI P. Oesch