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Dissecting star-forming region within galaxies in a proto-cluster at z=2.53 with Subaru/IRCS+AO188

based on Suzuki et al. 2019, PASJ, 71, 69

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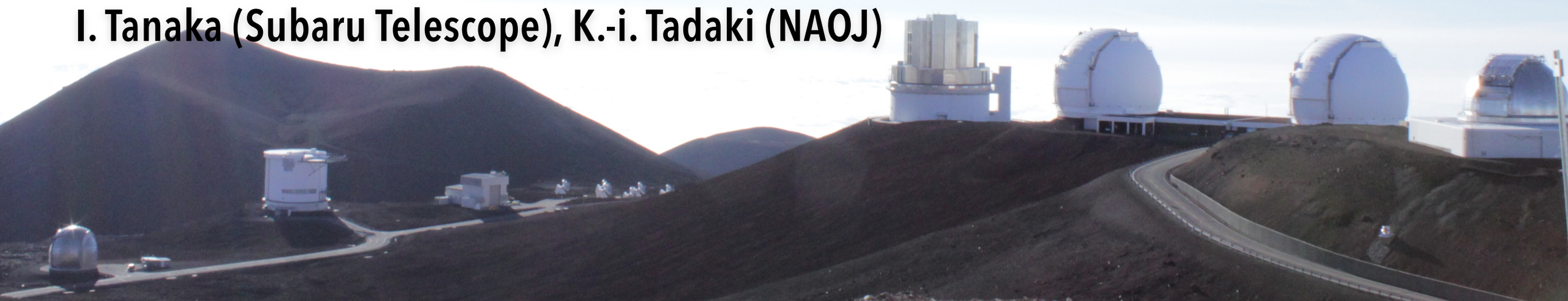
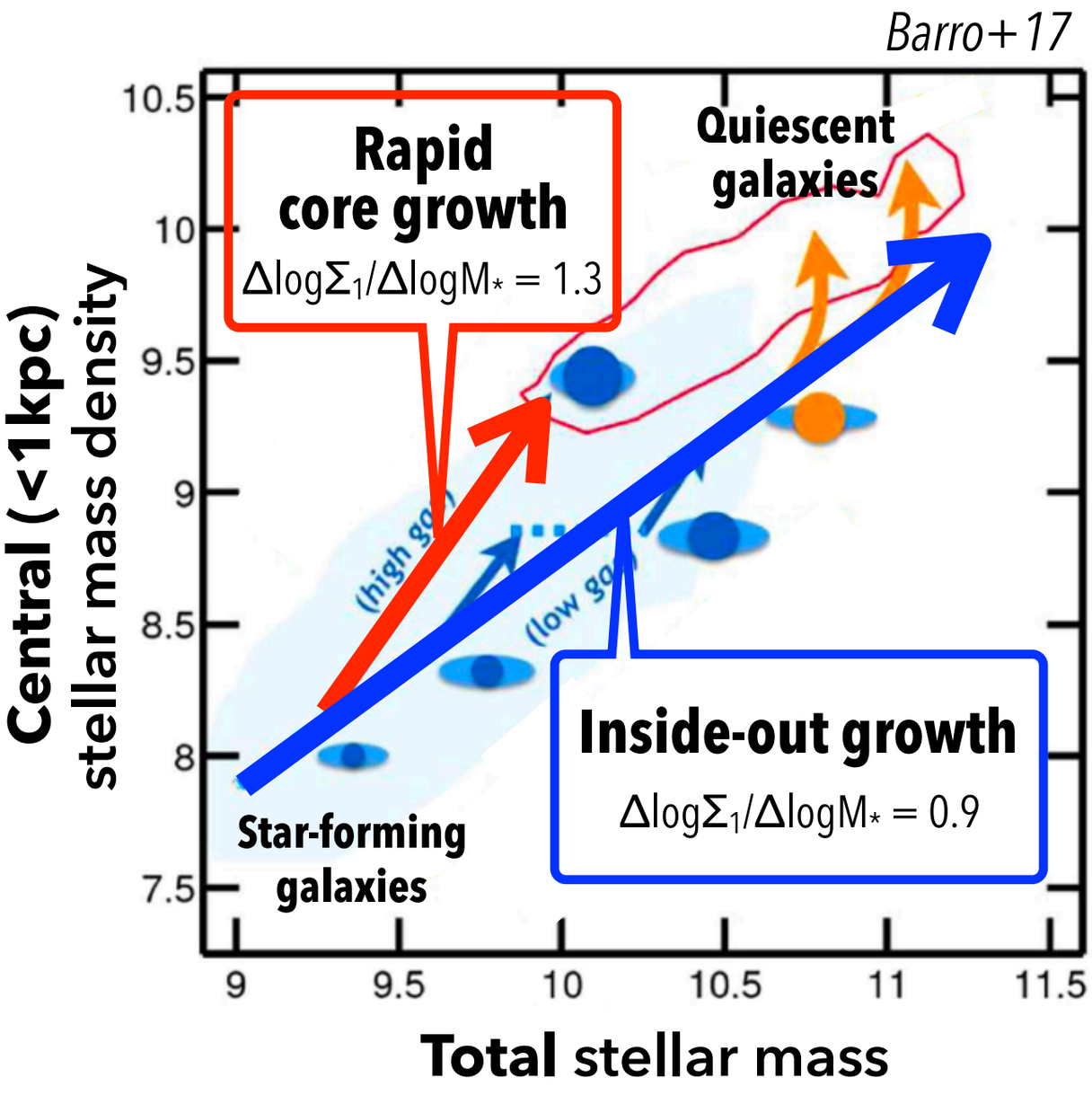


Structural growth of star-forming galaxies



- **Inside-out growth**
  (e.g., Trujillo+06; Nelson+16)

  More extended star-forming region

- **Rapid core growth**

  Centrally concentrated and active star formation

  Induced by …?
  - Gas rich mergers
  - Violent disk instability

  (e.g., Tacchella+16)

Environmental impacts on the structural growth?

In high-density environments…

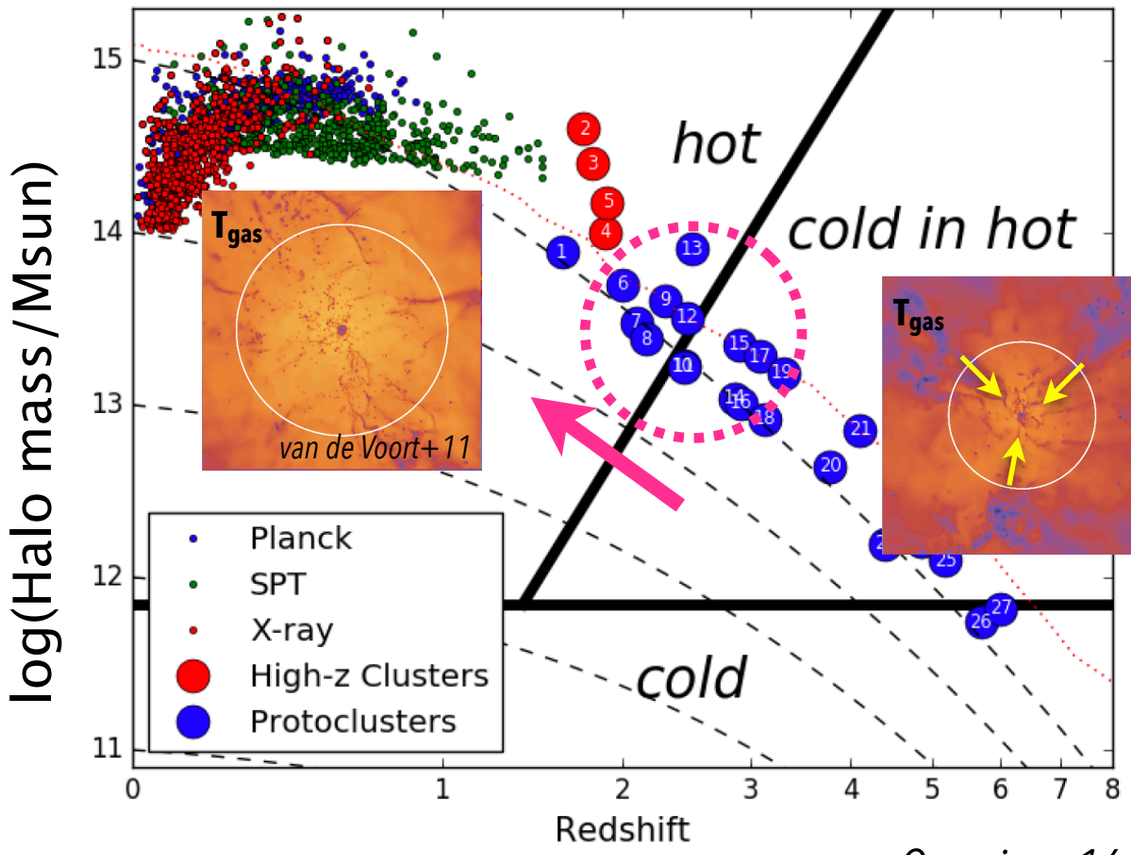
- **Different mode of gas accretion**

  (e.g., Dekel+09; van de Voort+11)

  Gas accretion is important to keep gas-rich unstable disks

- **Higher merger frequency**

  (e.g., Lotz+13; Hine+16)



Overzier+16

→ Contributions of the two phases may change?

Investigate the spatial distribution of SF region for galaxies in high-density environments

AO+NB imaging for high-z galaxies with Subaru/IRCS

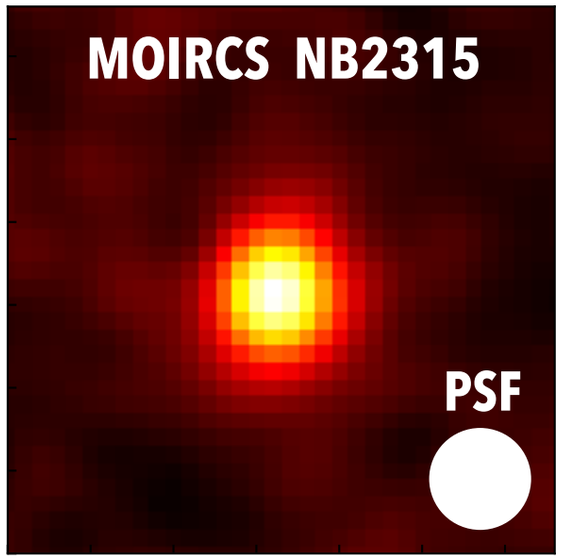
- co-PIs: Y. Minowa and Y. Koyama
- Observation

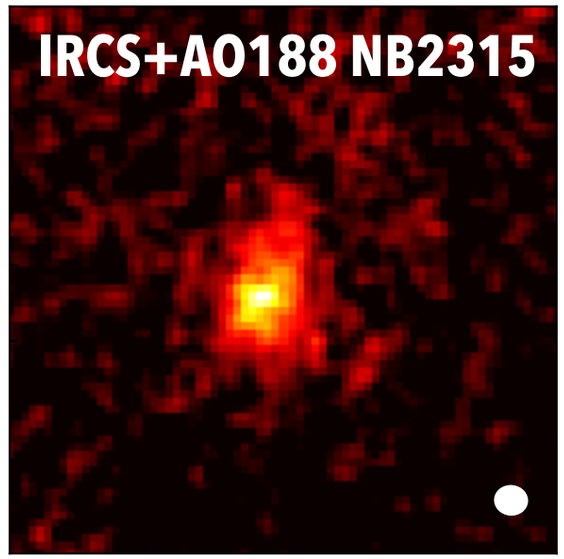
  Imaging with Subaru/IRCS+AO188 and NB filter

  - **Spatially resolve line-emitting region**
    - 0.1-0.2 arcsec resolution

      → **1-2 kpc @ z~2**

Hα emitter at z = 2.5



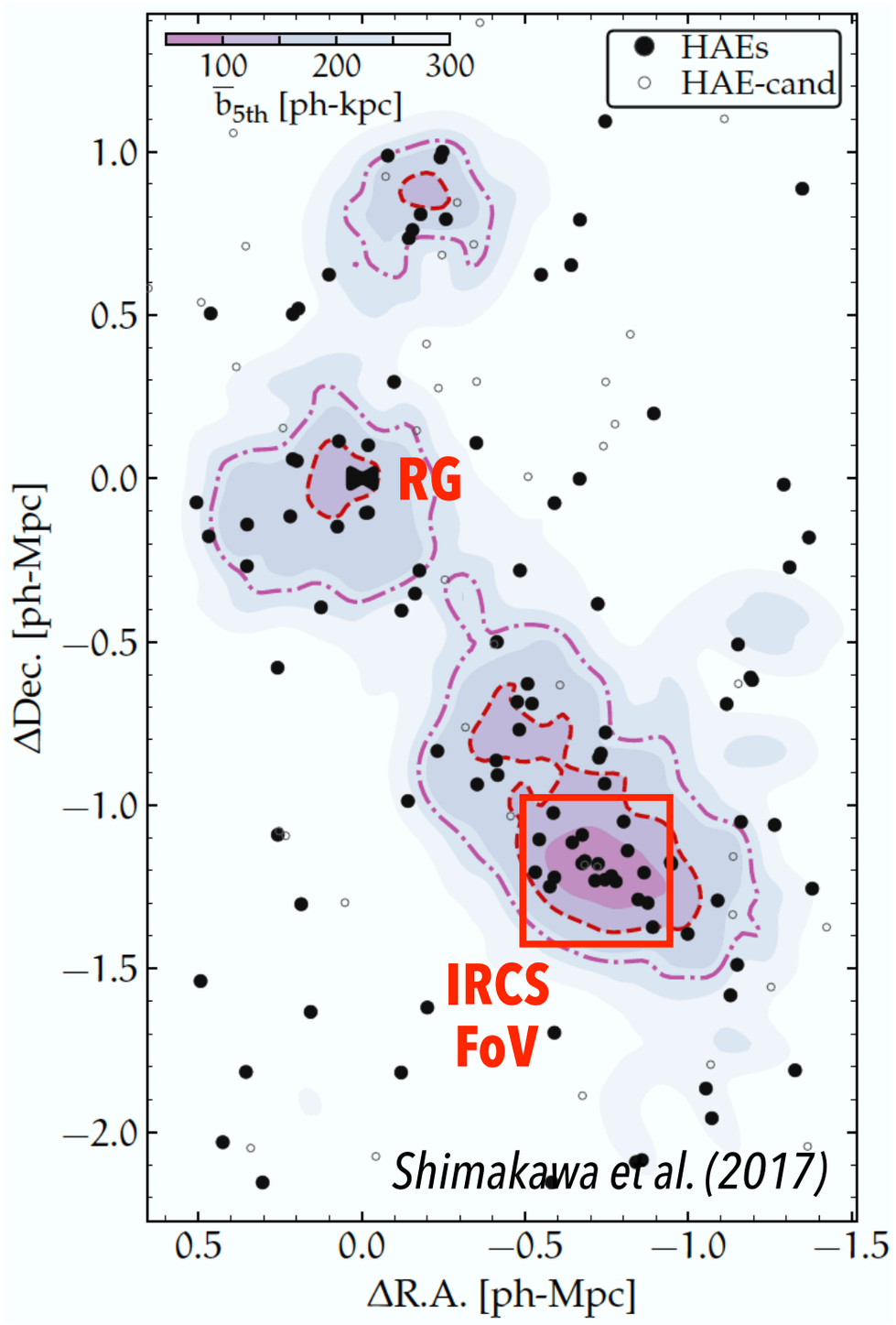


- Targets

  NB-selected Hα emitters at z = 2-2.5

  - General field: UDS, COSMOS (Minowa et al.)
  - Proto-cluster field: **USS1558 (This work)**, PKS1138

USS1558: a proto-cluster at z=2.53



- A high-density region around a radio galaxy at z=2.53 (Kajisawa+06)

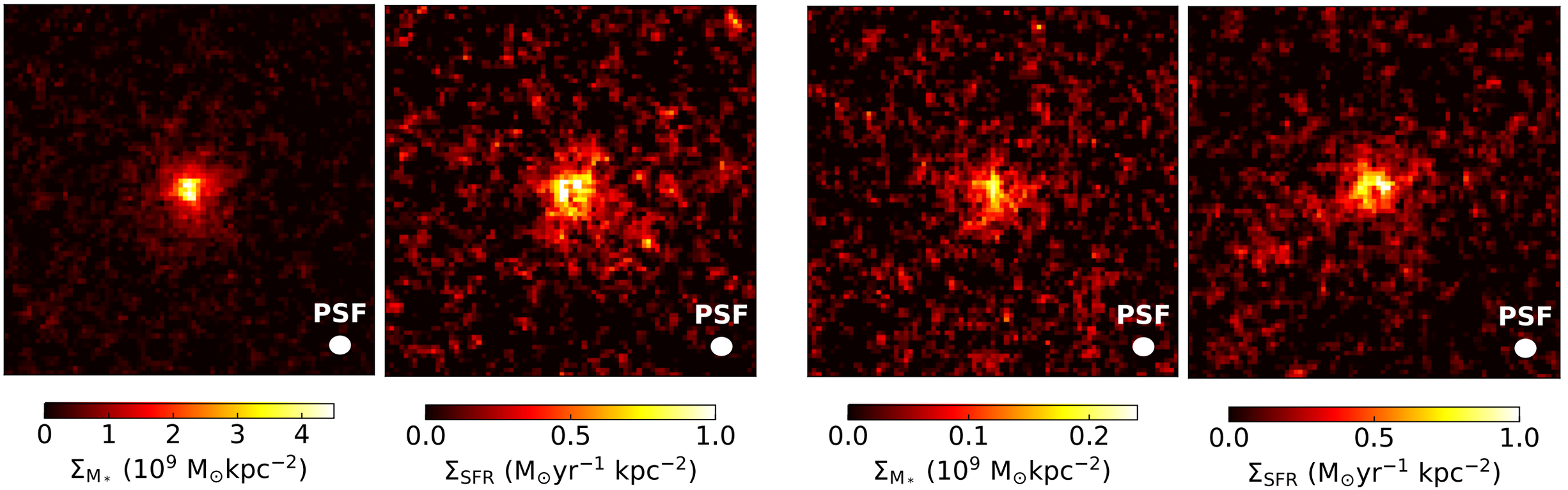
- Deep MOIRCS NB observation
  → 107 Hα emitters
  (Hayashi+16; Shimakawa+18)

- **IRCS+AO188 observation**
  - May 2013, 2014 (PI: Y. Koyama)
  - **The densest group of HAEs**
    → proto-cluster core
  - 11 HAEs with $M_* > 10^{9.5}\ M_{sun}$ are analyzed

Stacked images of M* and SFR(Hα)

High-mass sub-sample
10 < log(M*/Msun) <= 11.1

Low-mass sub-sample
9.5 < log(M*/Msun) <= 10

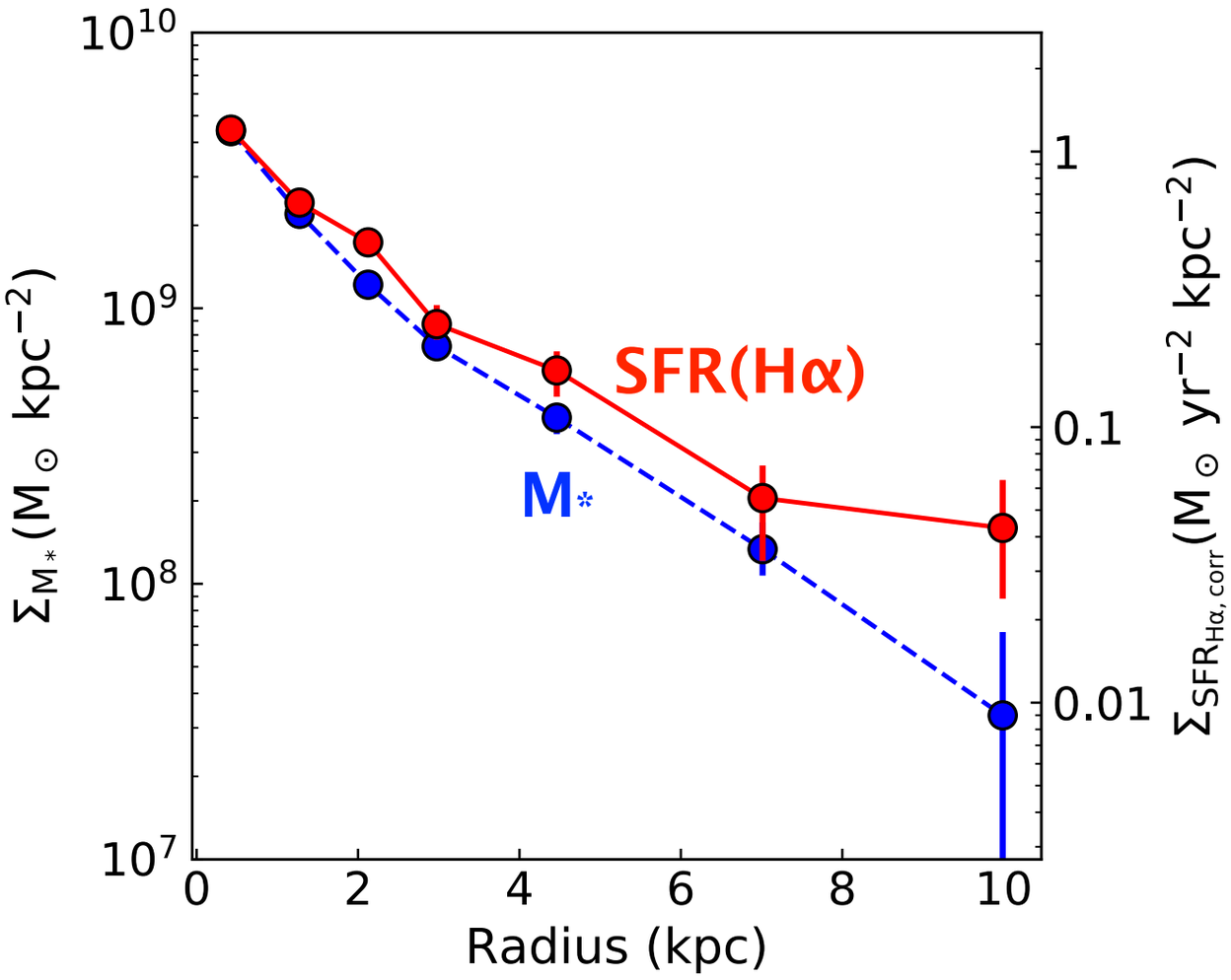


4.3"x4.3" image

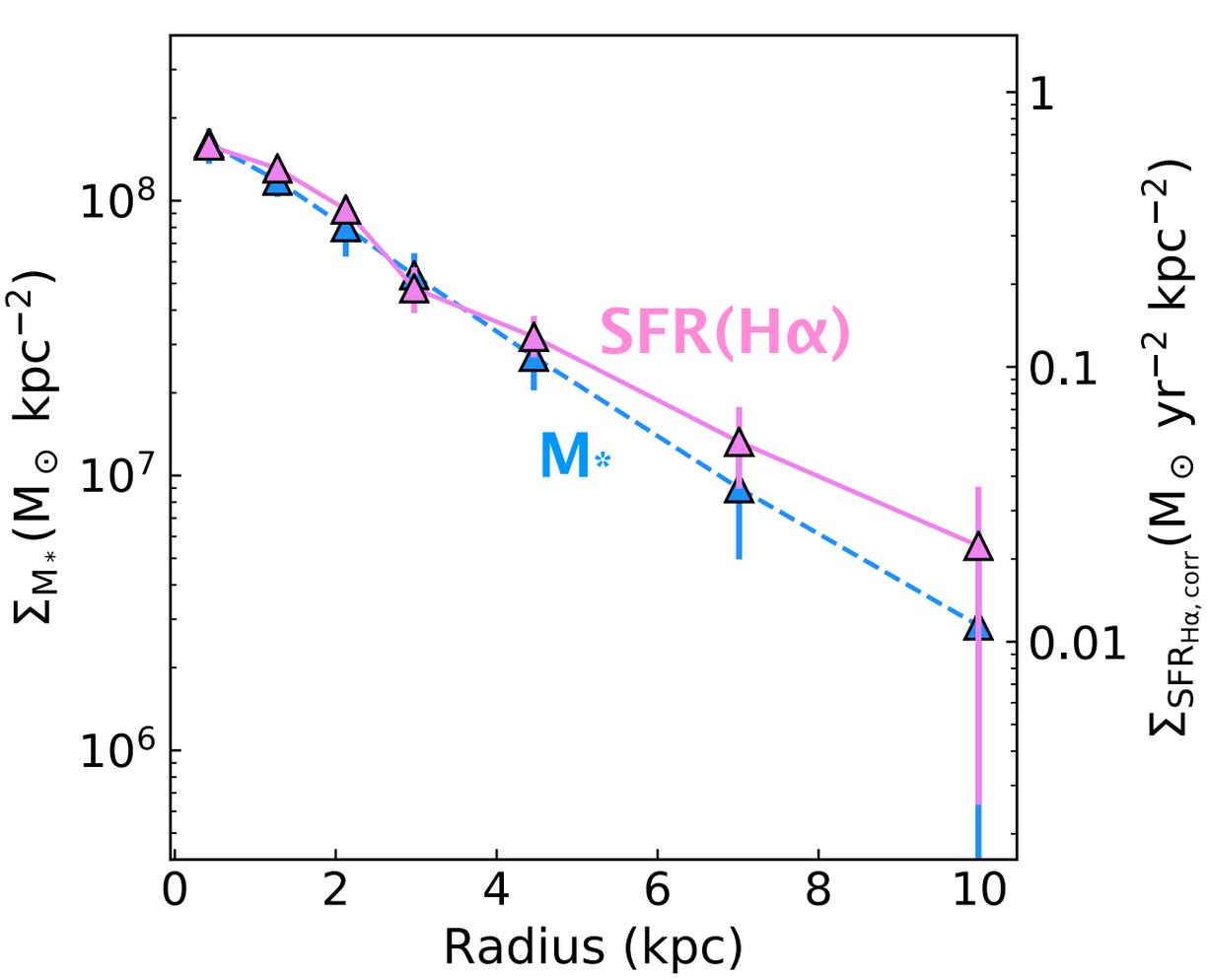
- PSF size: **0.25" → 2.5 kpc @z=2.5**
- K' image = Stellar continuum → Stellar mass
- NB-K' image = Hα+[NII] → SFR(Hα)
- Estimate radially dependent dust extinction with the Hα images and HST/ACS I-band image (Koyama+15' method)

Extended star-forming region of massive SFGs

High-mass sub-sample
$10^{10} M_{sun} < M_* <= 10^{11.1} M_{sun}$

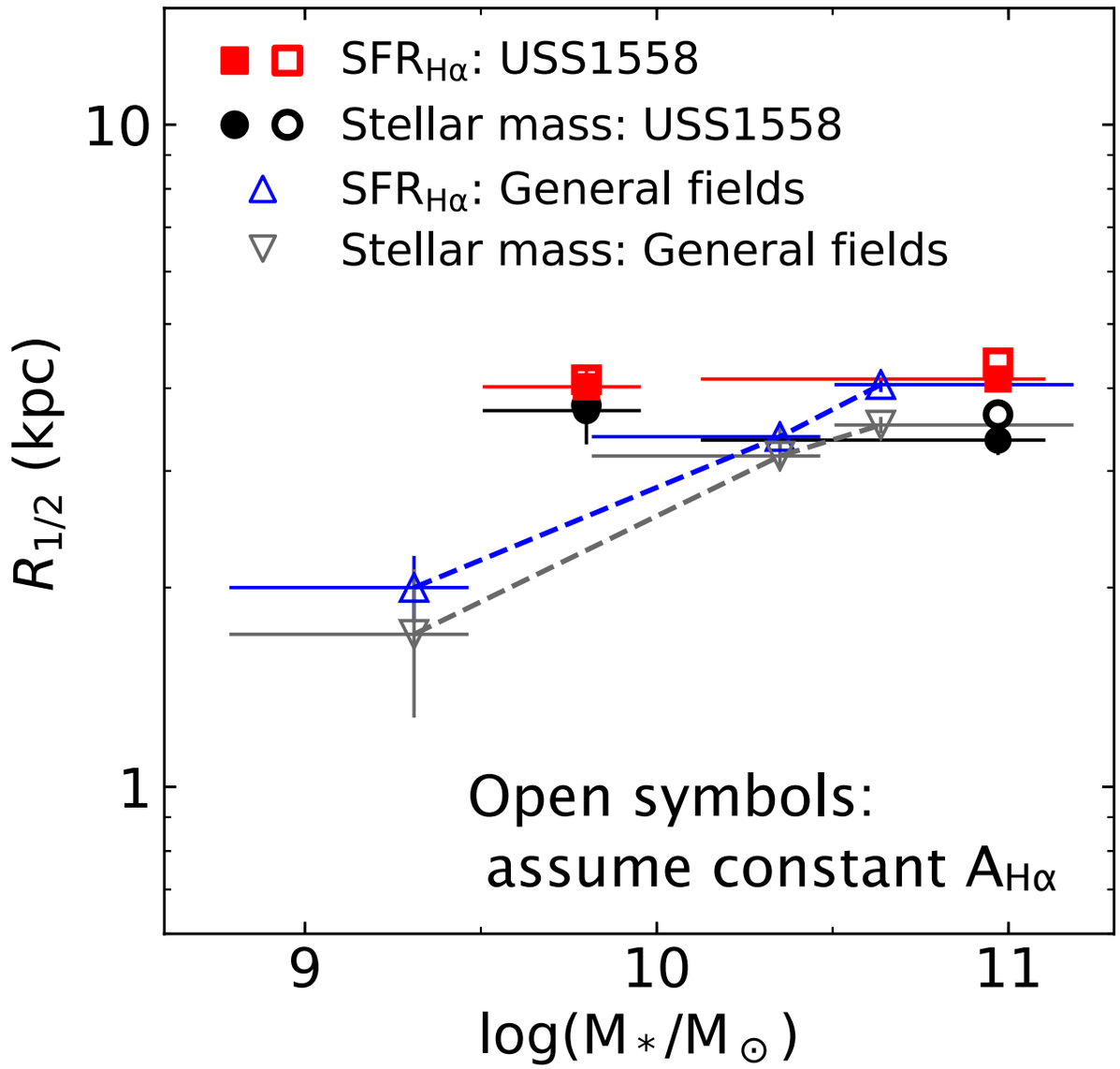


Low-mass sub-sample
$10^{9.5} M_{sun} < M_* < 10^{10} M_{sun}$



Star-forming region is further extended than underlying stellar structure

Comparison with field galaxies at z = 2-2.5



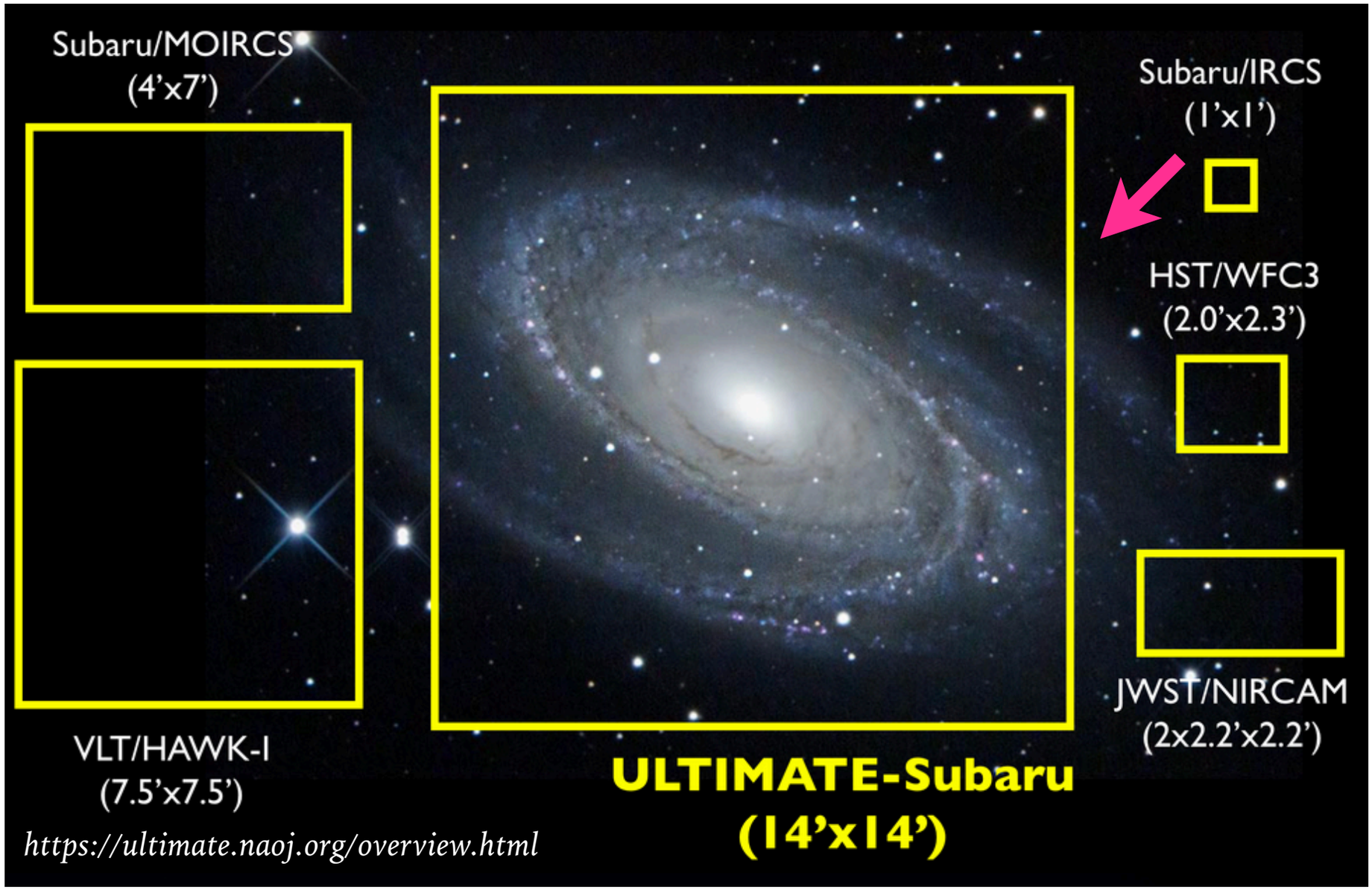
Field galaxies (Minowa+)
: 20 HAEs at z=2–2.5
from Sobral+13 and
Tadaki+13

- **No clear environmental dependence for massive SFGs**
- **Structural growth is mainly driven by internal secular processes in both environments**

Future prospect: ULTIMATE-Subaru

Wide-field NIR instrument + GLAO + NB filters

→ Statistical study for the structural growth of high-z galaxies



Summary

We conducted the AO-assisted K'+NB imaging observation with Subaru/IRCS+AO188 for the Hα emitters in the proto-cluster core at z =2.53

- Spatially resolve the Hα-emitting region within galaxies at z > 2
- **More extended star-forming region than stellar structure for the massive SFGs in the proto-cluster core**
- **No clear environmental dependence of the spatial extent of star-forming region**
- Structural growth of massive SFGs at z=2-2.5 is likely dominated by the internal secular processes irrespective to the surrounding environments