Subaru-UM ngAO Session (NAOJ-Mitaka, 2012/3/1)

Extra-Galactic Science with Subaru GLAO

Based on the Subaru ngAO workshop@Osaka on 2011/9/8-9

Tadayuki Kodama (Subaru) on behalf of the ngAO Science Workshop

The 1st Subaru Conference (Dec. 2007, Hayama)
Panoramic Views of Galaxy Formation and Evolution based on the results with wide field instruments

The X-th Subaru Conference:

"Narrow" *Views of Galaxy Formation and Evolution based on the results with Classical Adaptive Optics ??*

Venue…

Accommodation…

The X-th Subaru Conference:

"Panoramic" AND "Sharp" *Views of Galaxy Formation and Evolution based on the results with* ***GLAO****!*

The Mt. Fuji (3776m) on the Fuji river viewed from Shinkan-sen

Advantages of GLAO on Subaru

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Ground Layer AO: 0.2” @2μm ⇔ ~1.5kpc @z>1

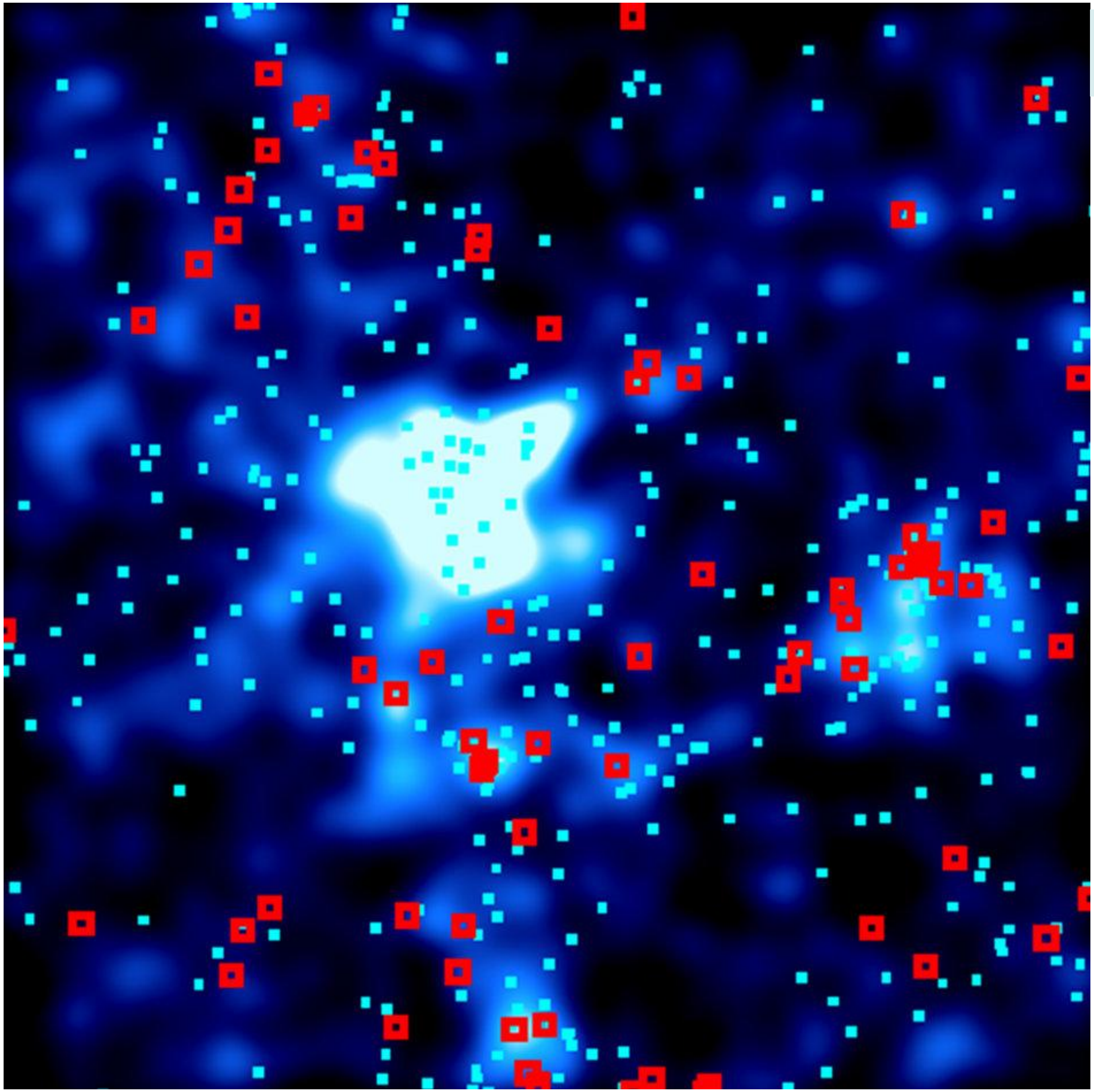
Stars and gas within galaxies can be “just” resolved.

Field of View can be as large as 10-15 arcmin with GLAO

At the same time, statistical studies are possible.

- Imaging (+NB filters?)
  - galaxy morphologies (Hubble types, mergers, size)
  - distribution of star formation within galaxies
- Spectroscopy (multi-IFU):
  - internal kinematics (rotation/random, inflow/outflow)
  - metallicity distribution

Red emitters are found in the outskirts and in groups !



"Octopus cluster" (CL0939@z=0.41)

Koyama's talk

☐ **red HAEs**

■ **blue HAEs**

SFR>0.75$M_\odot$/yr

What are they?
Dusty SF? or
Passive+AGN?

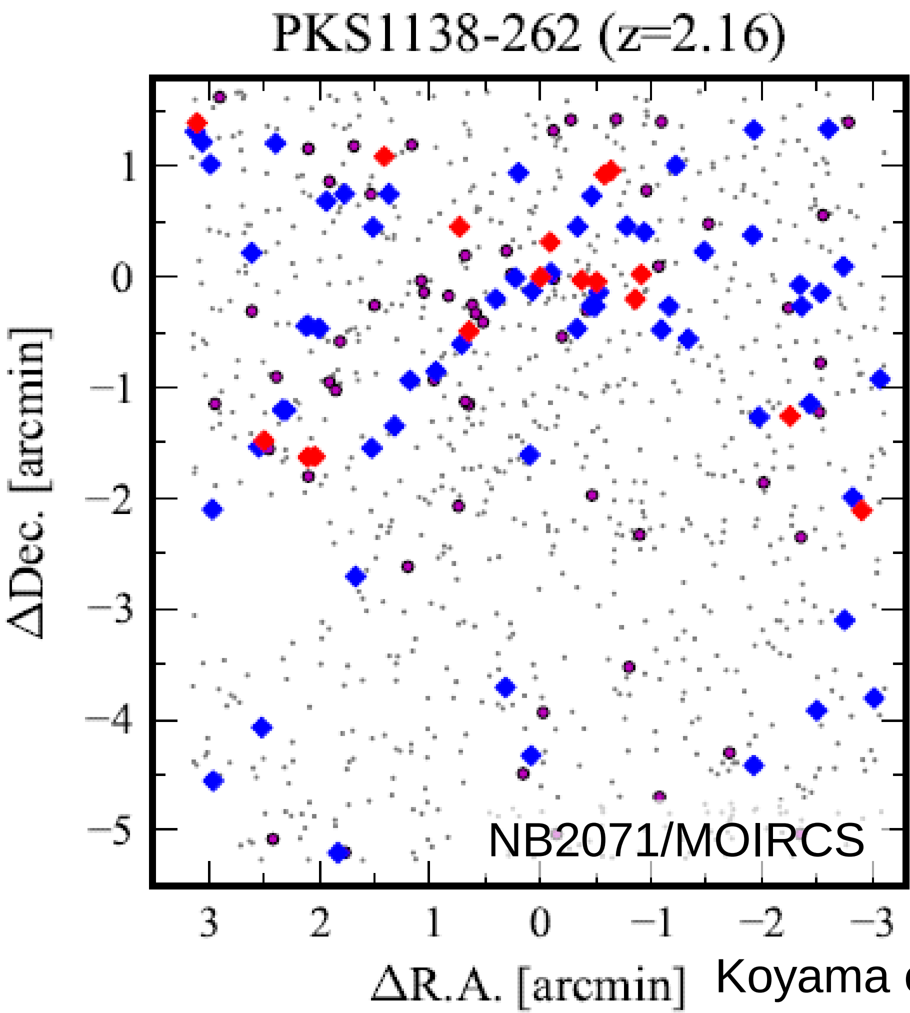
What is their origin?

NB921 imaging
of Hα emitters
i z=0.4 cluster

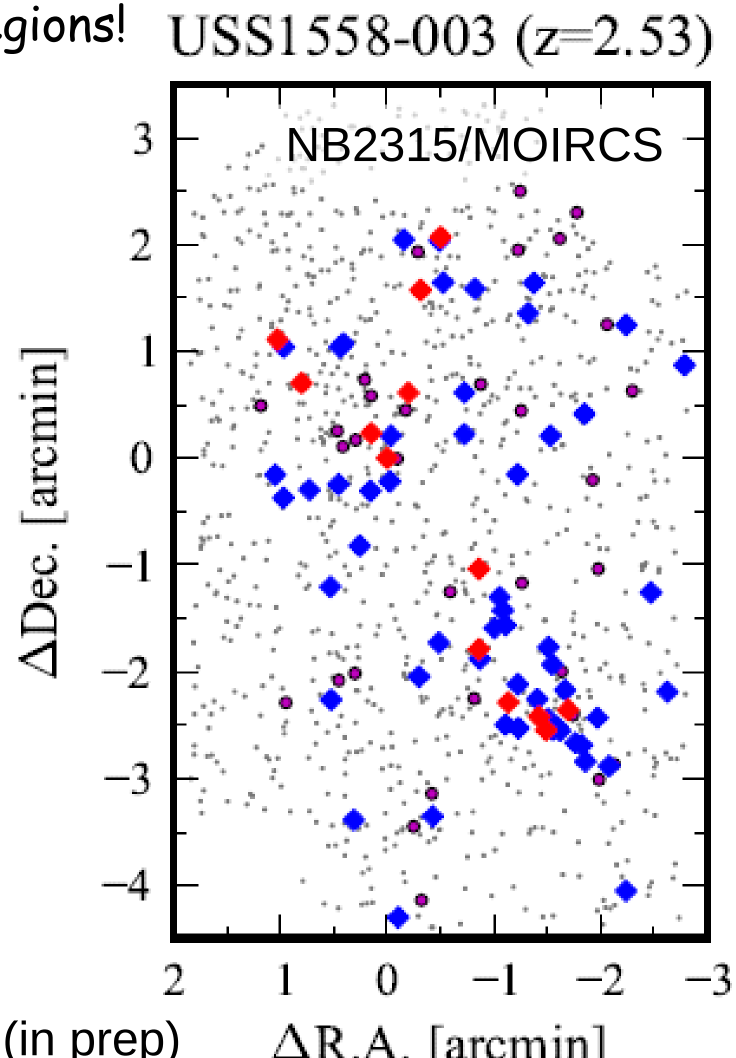
Koyama et al. (2011)

Hα emitters in two high-z proto-clusters at z>2

"Red emitters" tend to favor high density regions!



Koyama et al. (in prep)



Hayashi et al. (2012),
See Hayashi's talk

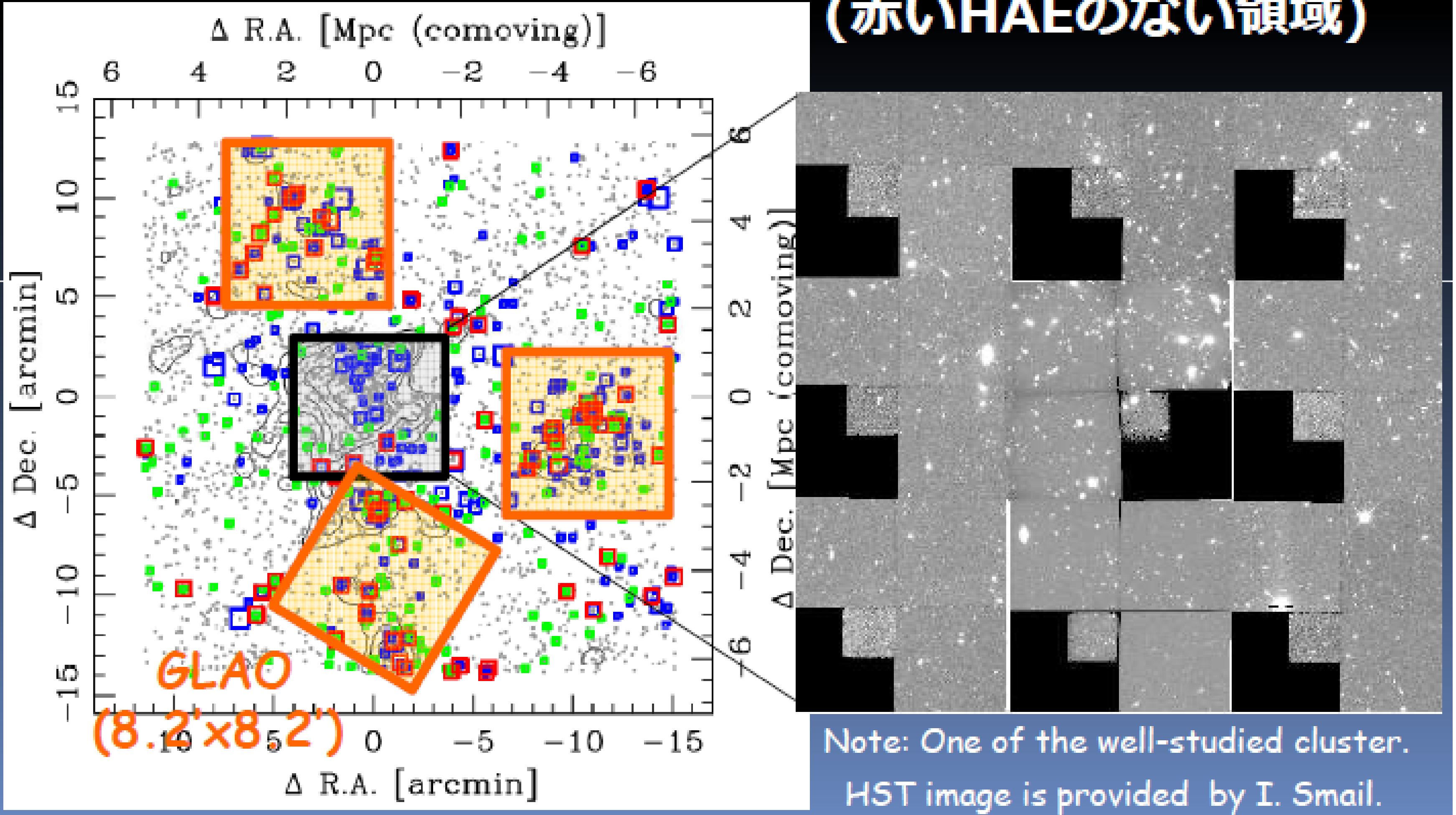
What's the origin of "red" Hα emitters?
Dusty+SF (SF mode)? or Passive+AGN (AGN activity)?

Koyama’s talk

What are the morphologies of these red emitters?

HST morphologies are available only in the cluster core…

(赤いHAEのない領域)



Note: One of the well-studied cluster.
HST image is provided by I. Smail.

Any signature of galaxy-galaxy interaction?

Koyama’s talk

Science with AO + NB imaging

Spatially resolved SF distribution

- 銀河内のどこで星形成が起こっているか?
  (nuclear starburst か、extended disk SF か)
- S0銀河の形成とも関係
  (bulge growth?)

Tunable filter 検討の可能性は？

- HSC や FMOS などによって今後見つかるあらゆる redshift の大規模構造を NB サーベイするイメージ。
  (サンプル数の圧倒的な向上 + multi-line survey)
- 参考: SPICA も広視野を目指す。

Koyama's talk

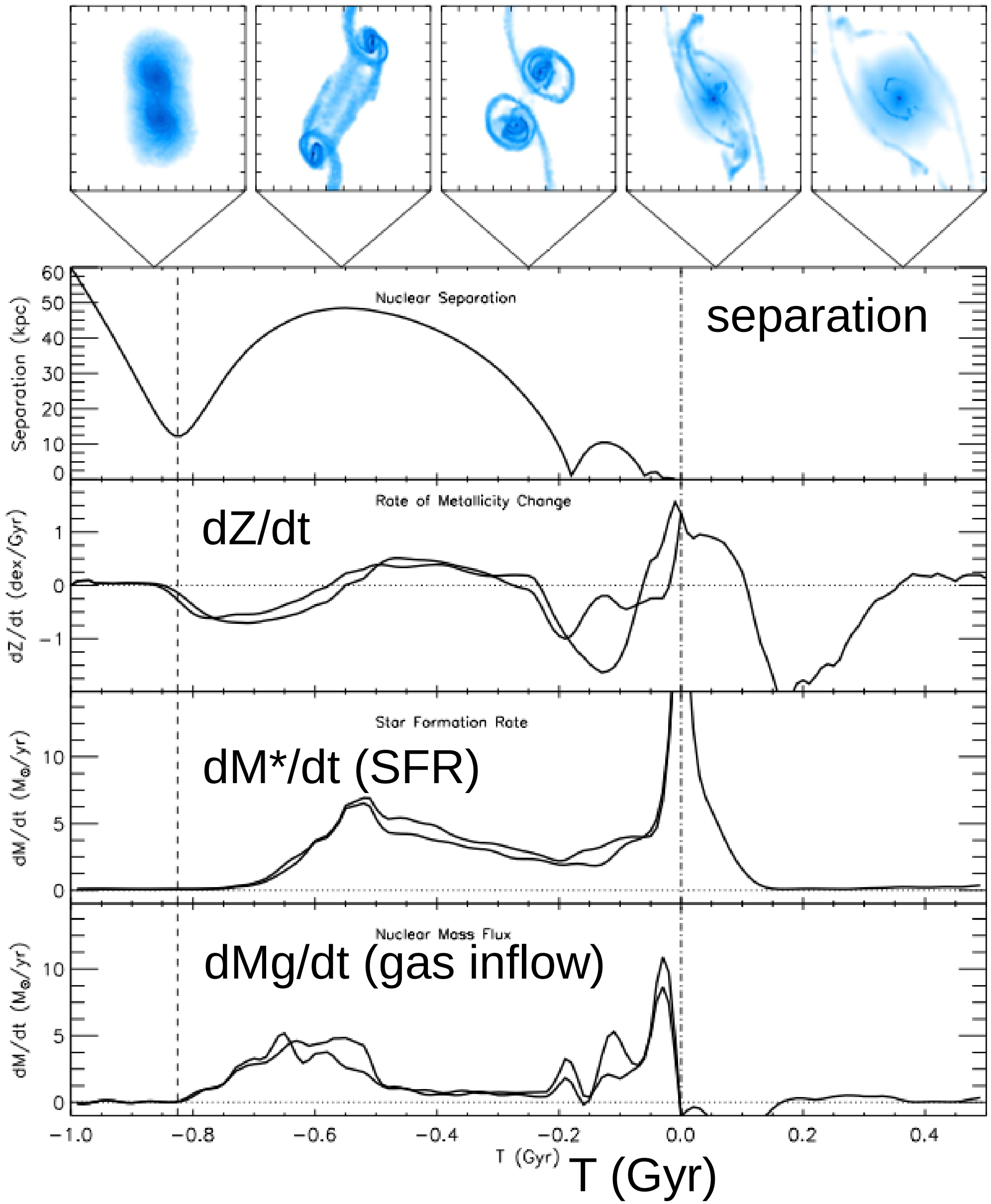
IFU ?

Importance of IFU

- 銀河内のどこで星形成が起こっているか?
  (nuclear starburst か、extended disk SF か)
  ただしこれはAO+NB撮像で観測視野全体で行える。
- kinematics の情報
  (merger の兆候はあるか、普通の disk rotation か)
- Spatially resolved line ratios (AGN, Hα/Hβ, metallicity)

KMOS type multi-IFU with assistance of GLAO will be unique!
(24 units in 7.2' Φ FoV)

SF and chemical evolution in merging galaxies



N-body/SPH (GADGET-2) Simulation

Torrey et al. (2011)

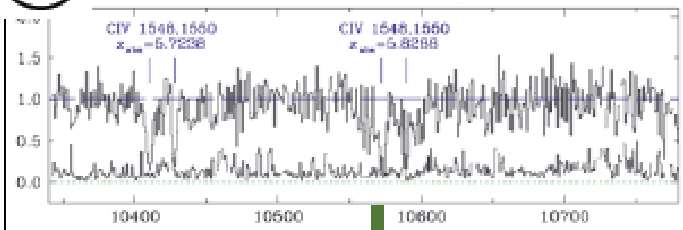
Gas which lost angular momentum through merger fall into galaxy center and decreases the central metallicity Initially, but the subsequent starburst increases metallicity later on.

Direct comparison with numerical simulation!

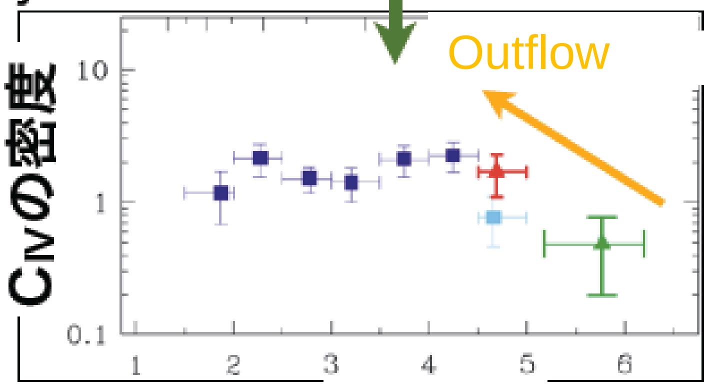
Shibuya's talk

Outflows from distant galaxies

② QSO absorption lines

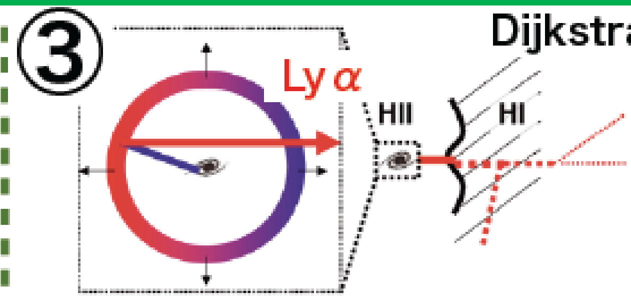


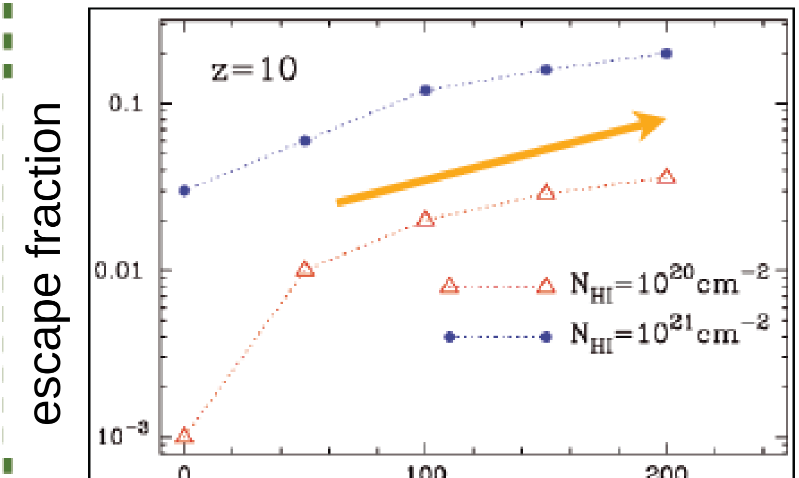
Ryan-Weber+2010



銀河間の金属量変化にも関係？

③ Dijkstra+2009



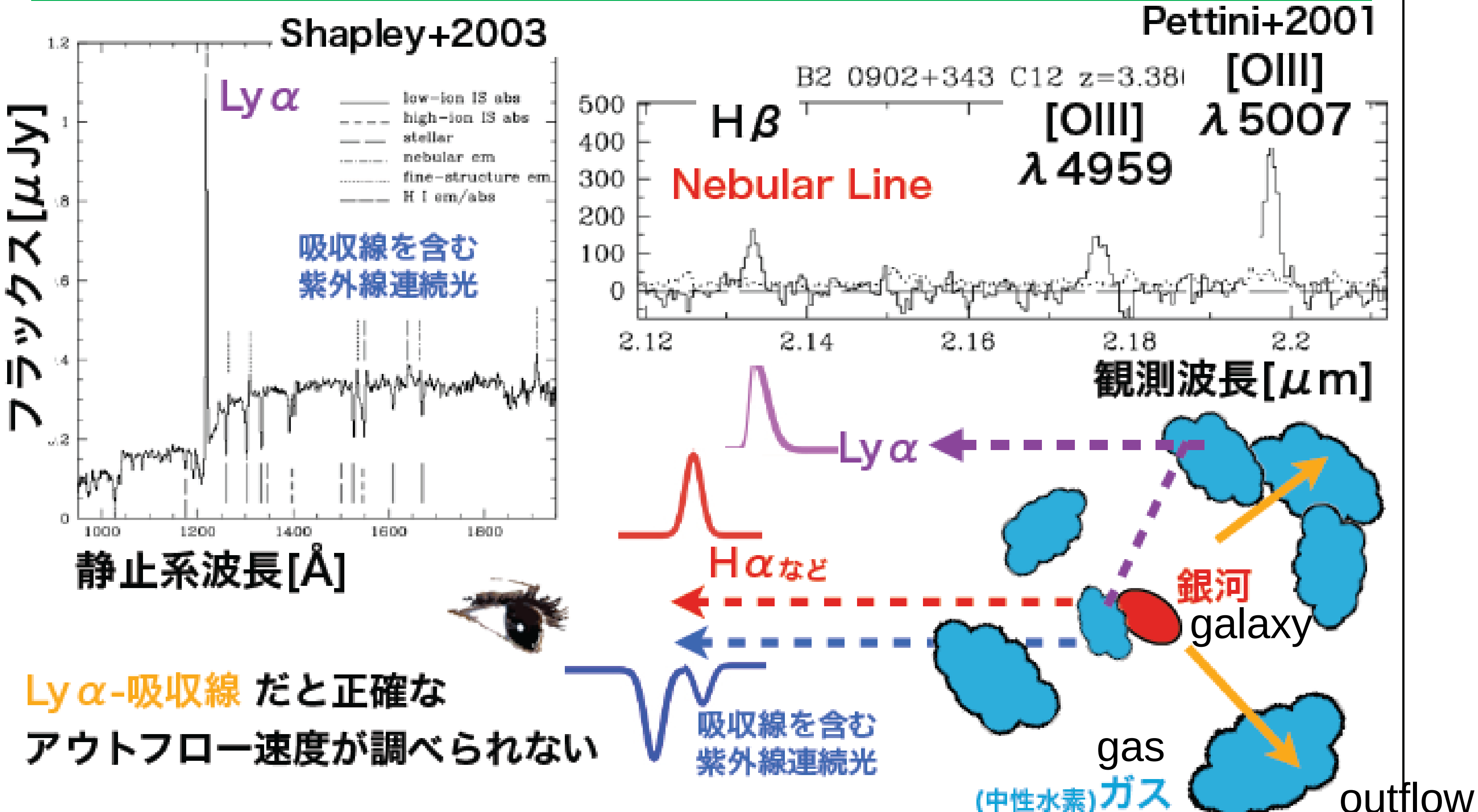


アウトフローにより Lyα脱出率が増大
→宇宙再電離への正確な制限

他にも，銀河 LF, ULIRG→QSO進化などにも重要な役割を果たす

Shibuya's talk

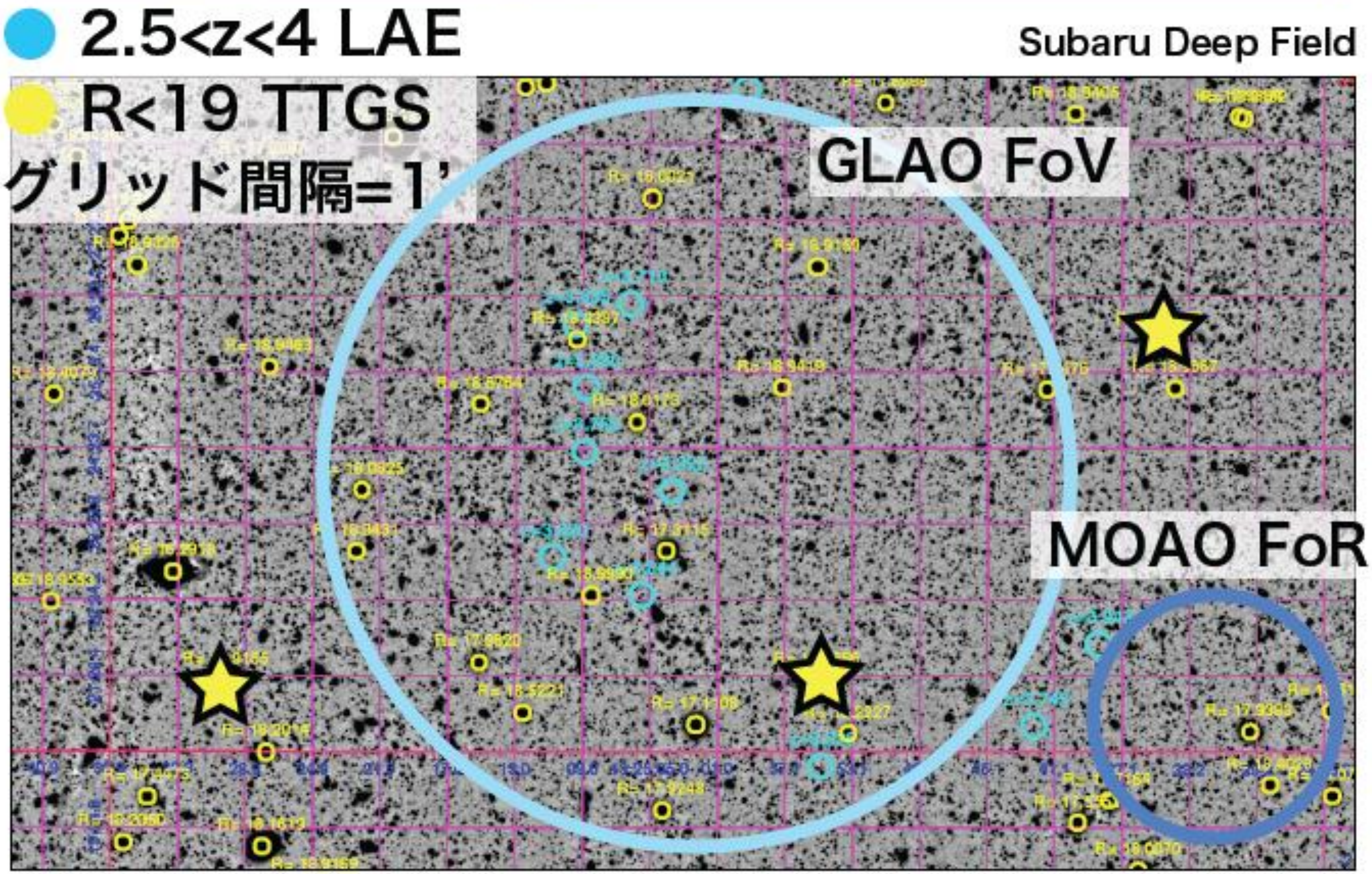
Outflows from distant galaxies



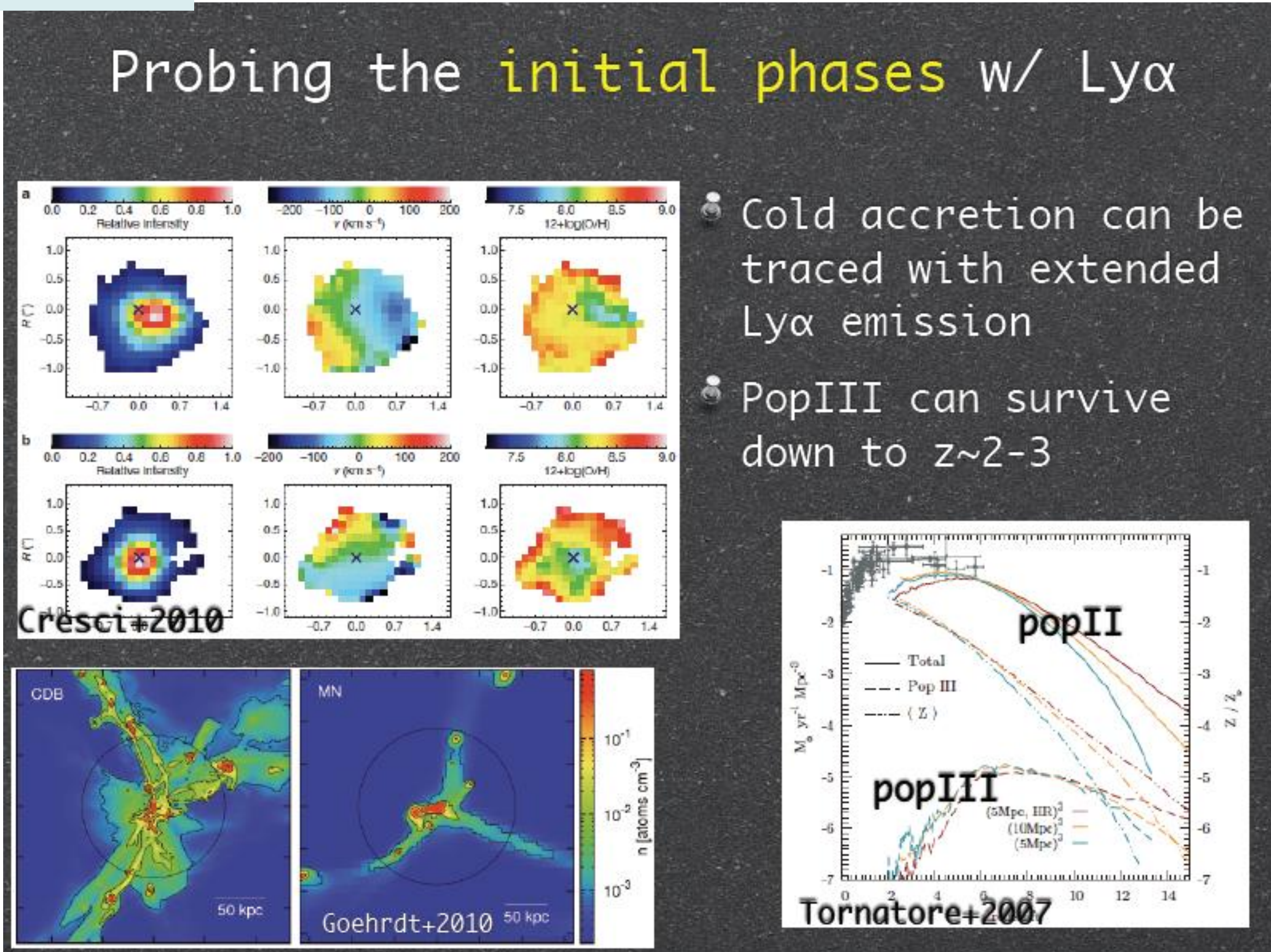
Velocity structure (bi-polar like outflow by AGN feedback?) or
Velocity offsets between Lyα and Hα/[OIII]/Hβ as a function of positions

Shibuya’s talk

Outflows at z~3 with ngAO



Saito's talk



Lower metallicity in the center → cold streams (pristine) may have decreased it?

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