scientific ideas from Taiwan

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presenting ideas from

Lihwai Lin, Youichi Ohyama, Yu-Yen Chang,
Ken Chen, Poshih Chiang

ideas

- finding the oldest, metal poor brown dwarves
- evolution of the star formation and LI(N)ER sequences
- quenching of galactic star formation
- inferring dark matter halo mass from neighboring galaxy counts: application to star formation activity in groups and clusters; dissecting the SF main sequence
- cluster galaxy evolution
- galaxy 3D shapes
- Lyman alpha blobs
- first galaxies
- ...

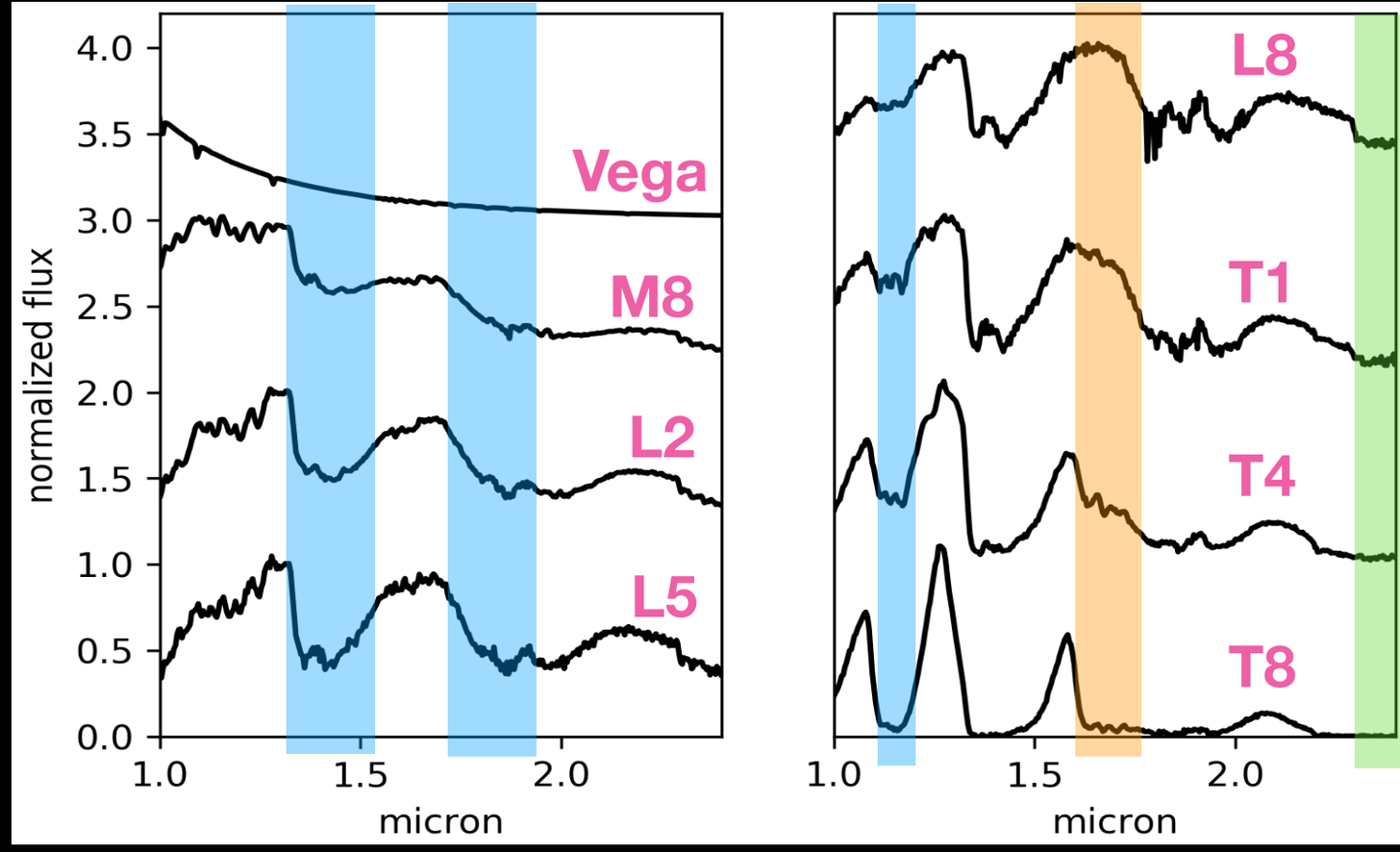
Poshih Chiang

- HSC + ULTIMATE : proper motions with 10-year baseline

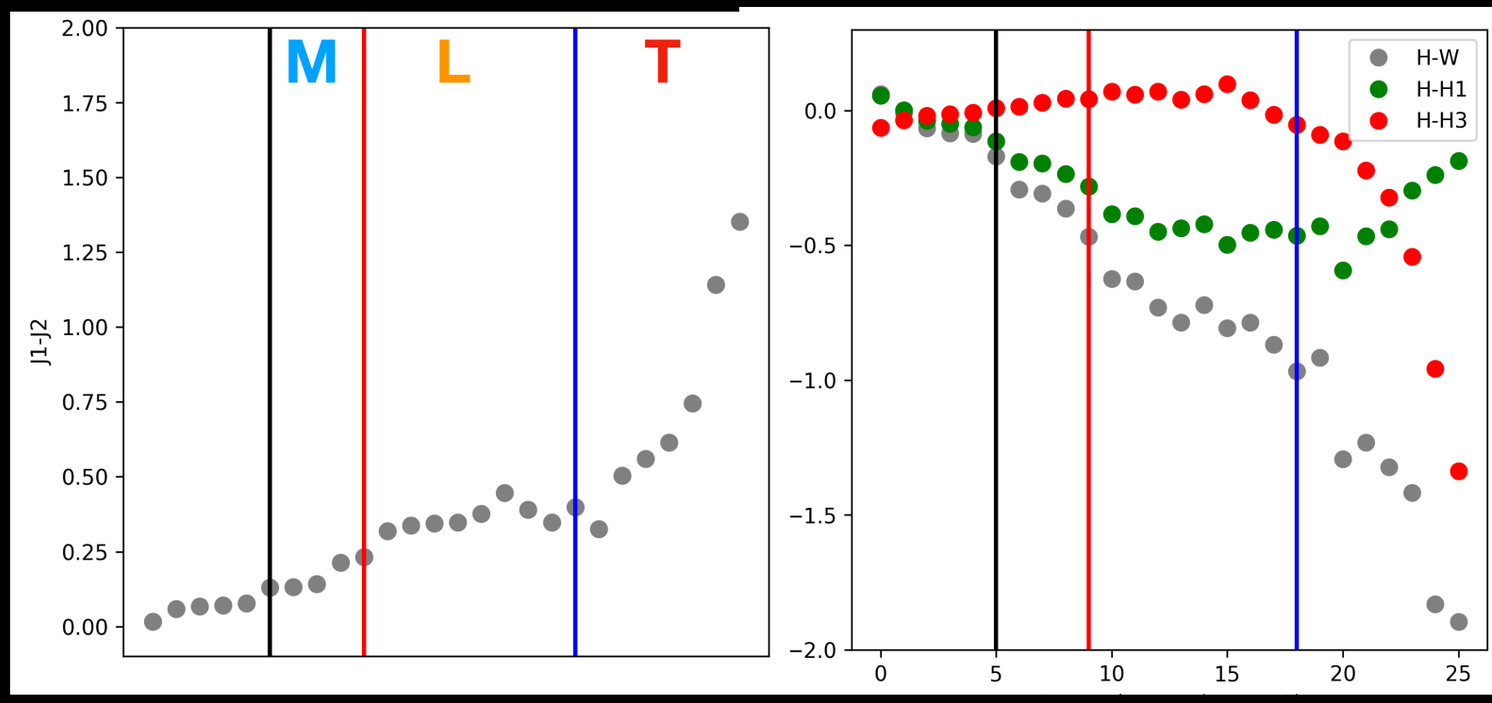
- medium bands are sensitive to molecular bands
  H2O: J1-J2, H-H1
  CH4: H-W3

- Volume-limited sample up to 200 pc for coolest L (thick disk)

- ULTIMATE goal — discovering Pop III brown dwarfs



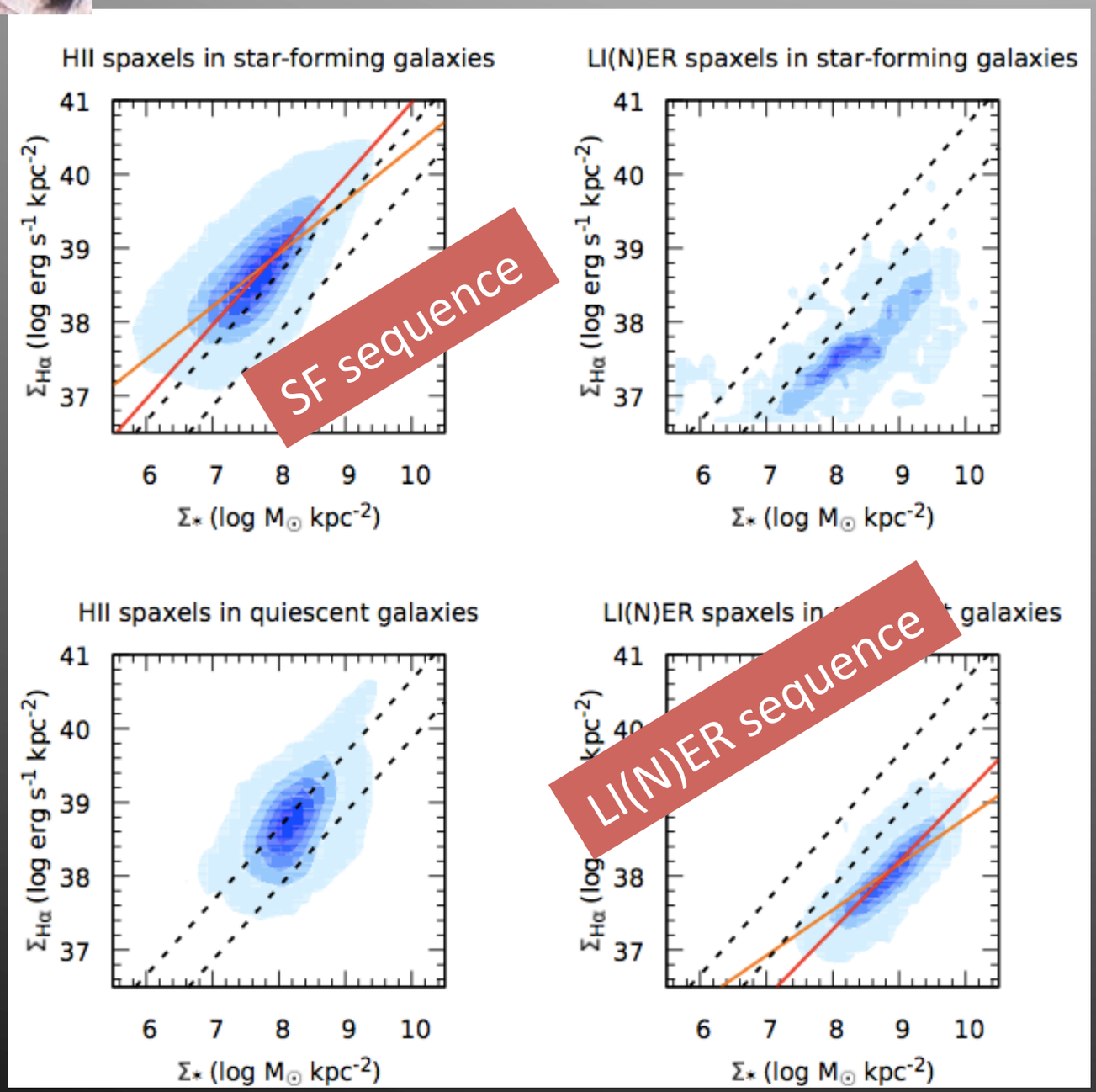
Infrared SEDs of brown dwarfs. Prominent molecular bands are marked in colors: H2O, CH4, and CO



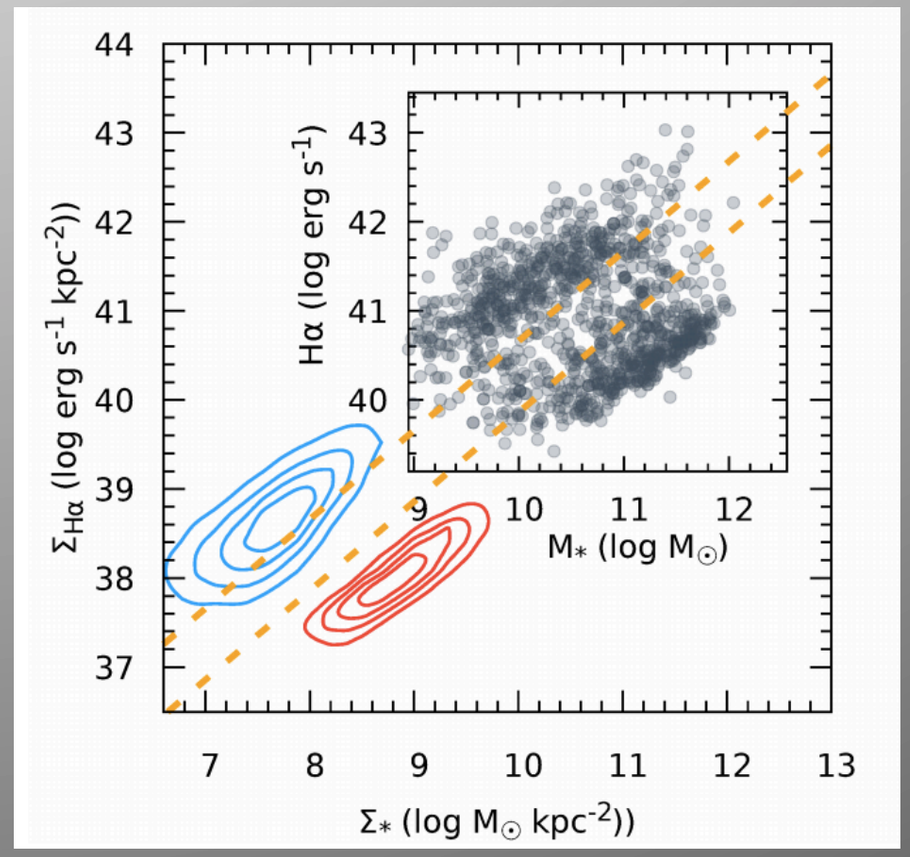
Synthetic photometry of median-band filters
Top: J1 - J2 Low: H-H1, H-H3, H-W (CFHT)

Resolved Star-Forming and LI(N)ER Sequences

Lihwai Lin, B.-C. Hsieh, Hsi-An Pan



B.-C. Hsieh et al. 2017

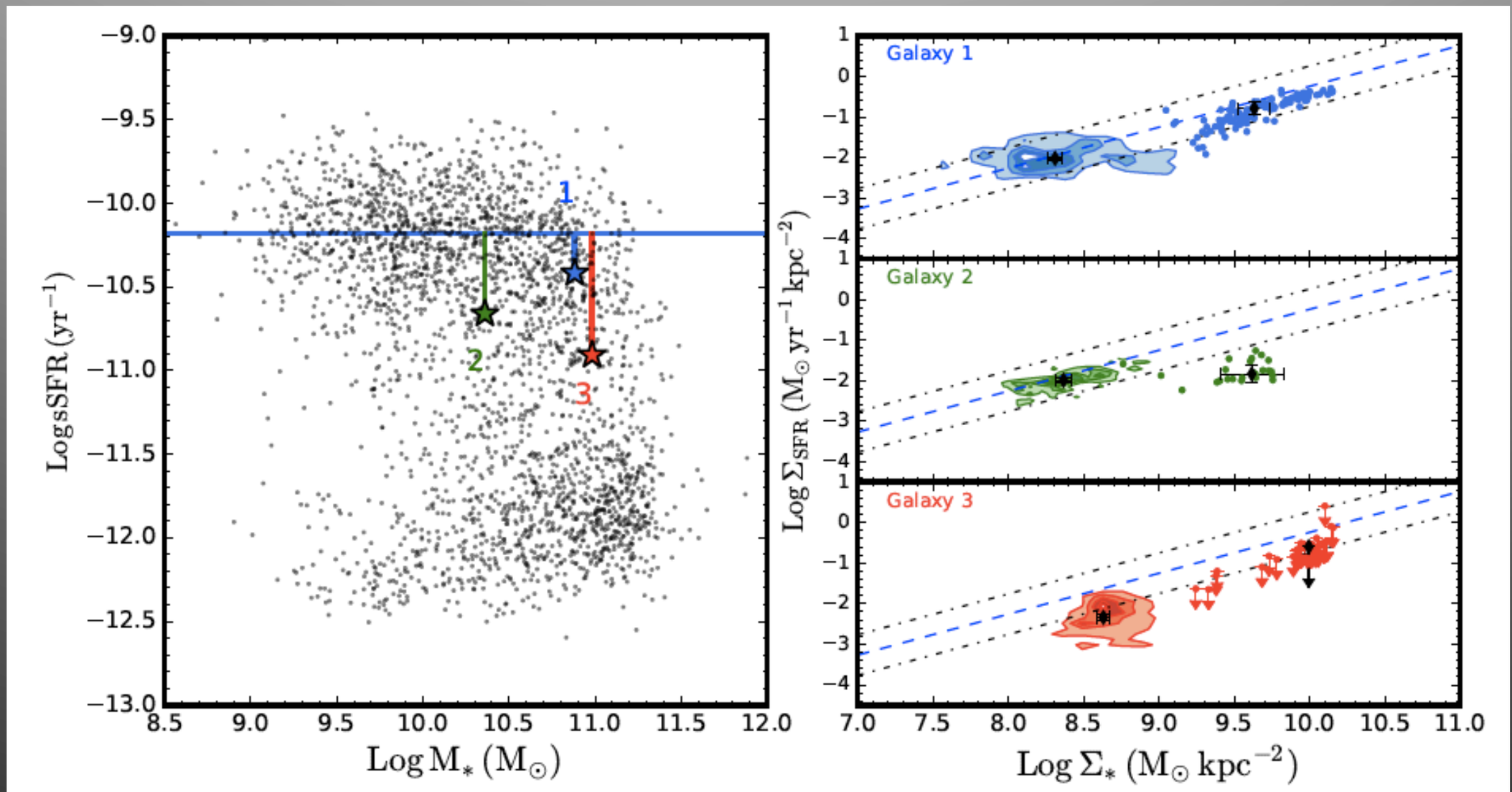


- In nearby galaxies, there exists a strong relation between the star formation rate surface density and the stellar mass surface density on Kpc scales, resembling the global main sequence.

- ULTIMATE SUBARU => How does this scaling relation evolve with redshifts?

SF Quenching at High-z

Lihwai Lin, B.-C. Hsieh, Hsi-An Pan

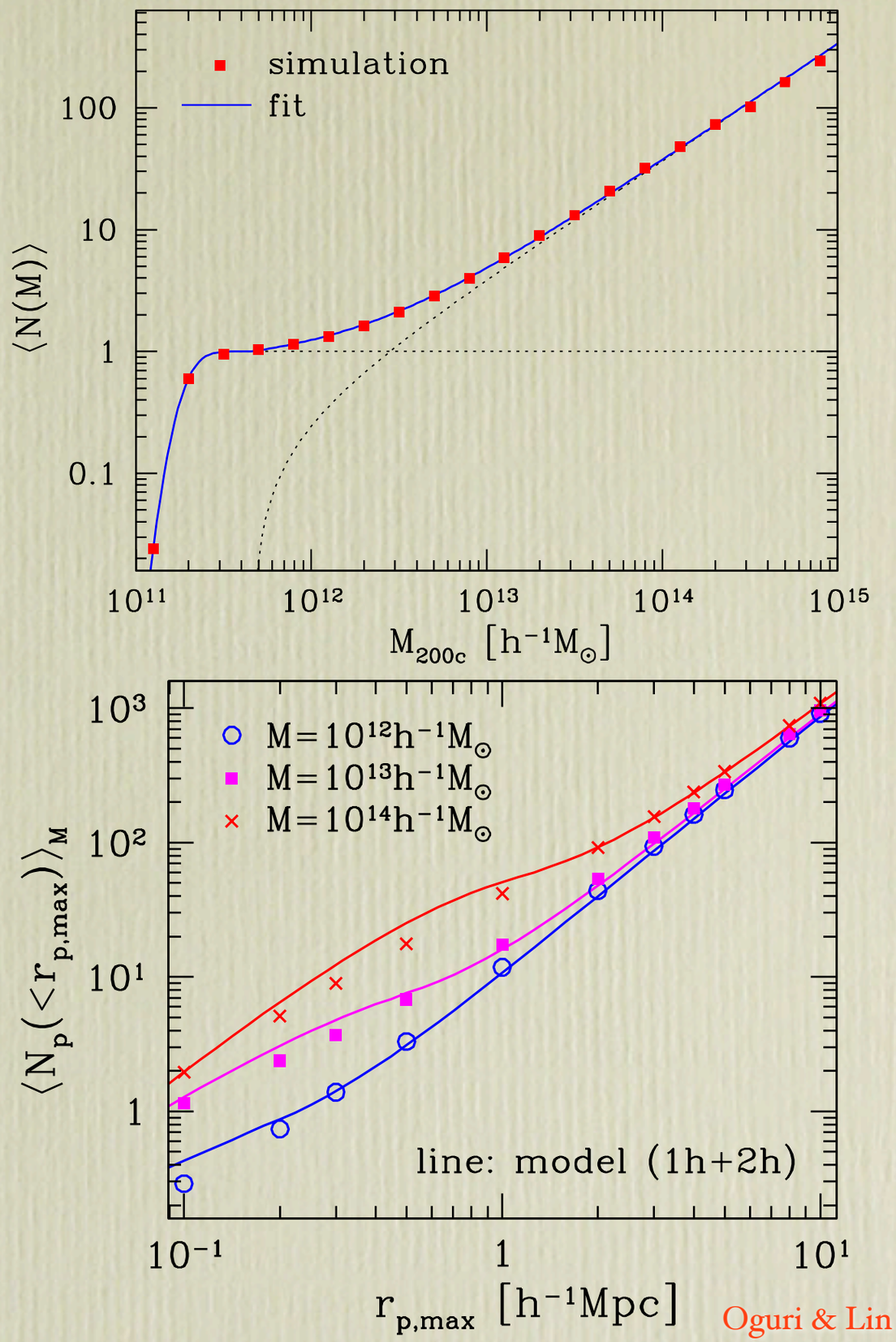


Lihwai Lin et al. 2017

Nearby galaxies show inside-out quenching. Combining ULTIMATE Subaru IFU and ALMA observations will reveal the quenching processes acting at high-z and their dependence on environments.

halo mass estimator: neighbor counts

- estimating halo masses is hard!
- most of existing methods give halo mass in a statistical sense (e.g., satellite kinematics, WL)
- for a given galaxy sample, we can infer its halo occupation distribution (HOD), in particular the halo occupation number
- for any galaxy in this sample, we can then infer the number of neighboring galaxies *within the same galaxy sample*
- analytical calculations within the HOD framework, separately for central and satellite galaxies, and for one- and two-halo terms



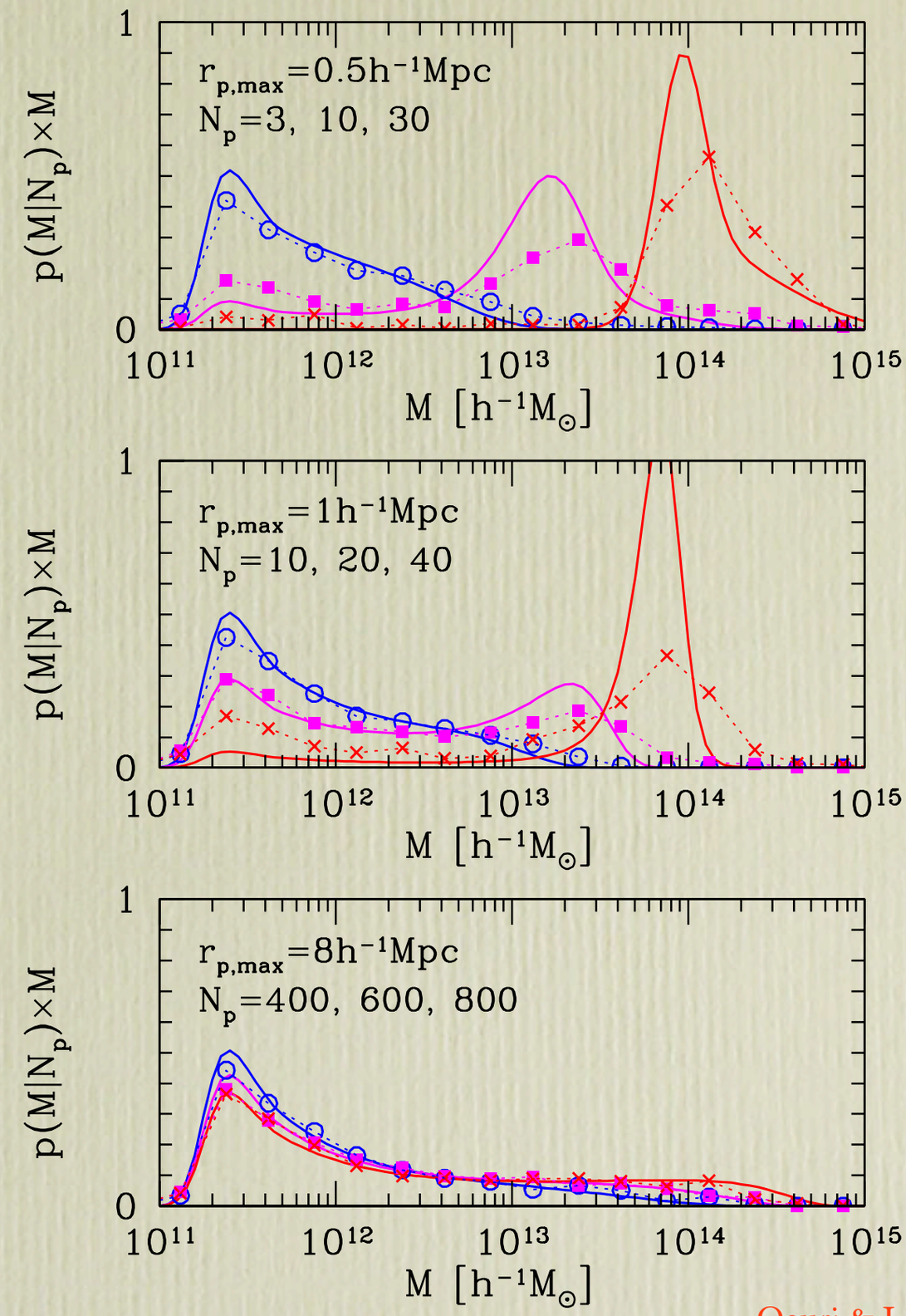
Oguri & Lin 15

halo mass probability distribution

- use Bayes' theorem to infer halo mass probability distribution function (pdf)

$$p(M|N) \propto p(N|M)p(M)$$

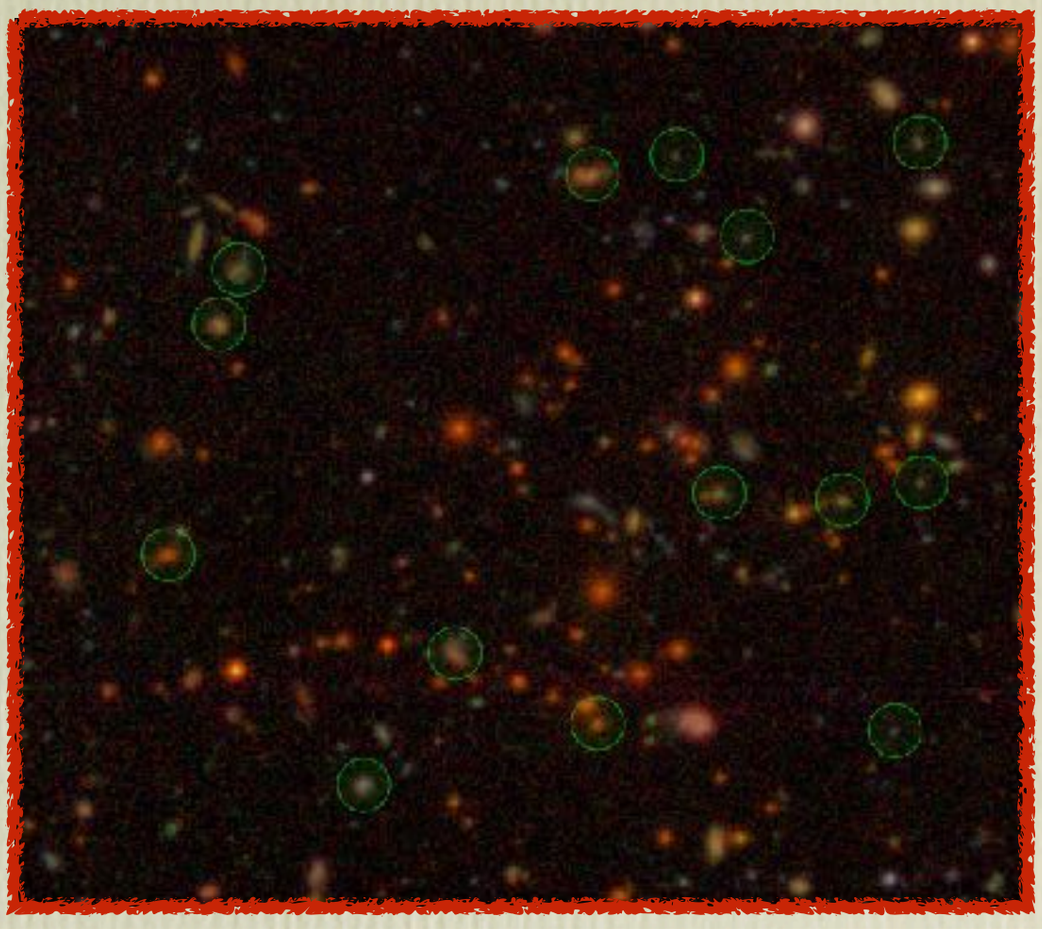
- we can thus infer halo mass for *individual galaxies!*
- model predictions match well with the mock results
- pdf often bimodal, due to uncorrelated large scale structures
- also gives probability of being a central

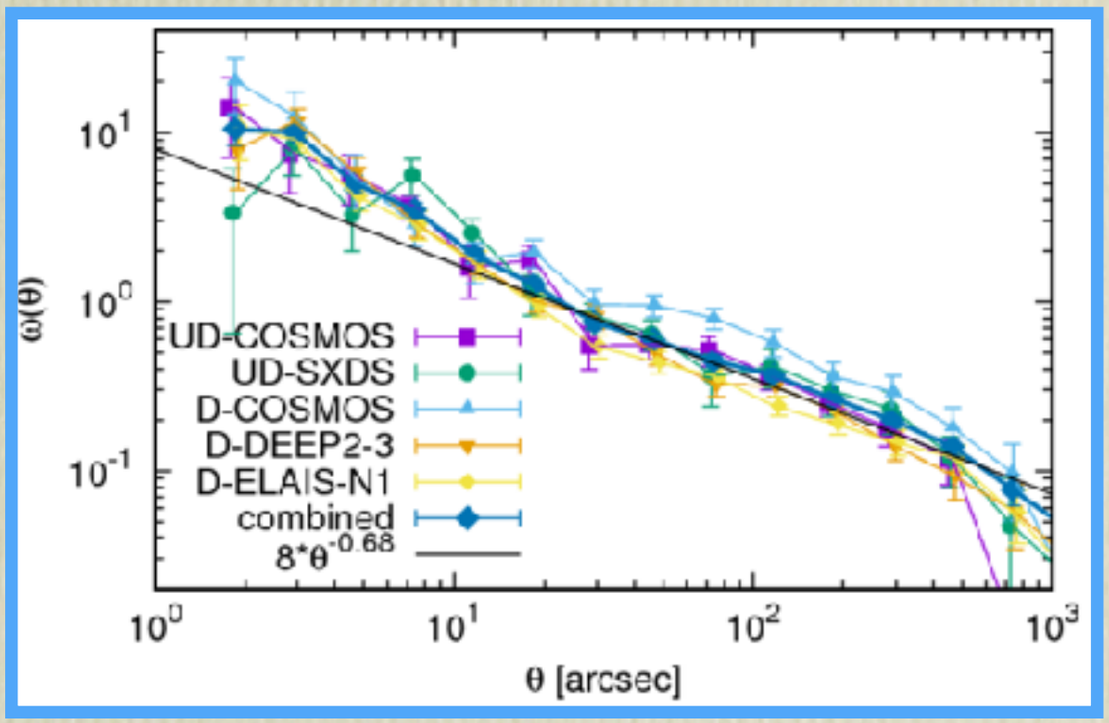


Oguri & Lin 15

potential application: mass of high-z clusters

- HSC has narrow band imaging in the deep fields
- can select [OII] emitters at z~1.19
- many emitters found to locate close to centers of 5 out of 6 HSC cluster candidates at z~1.15-1.2
- we have measured the angular correlation function of the emitters over the HSC deep fields
- once the HOD parameters of the emitters are estimated, we will apply the OL15 formalism and estimate the cluster mass
- can also study SF activity in these clusters via cross correlation

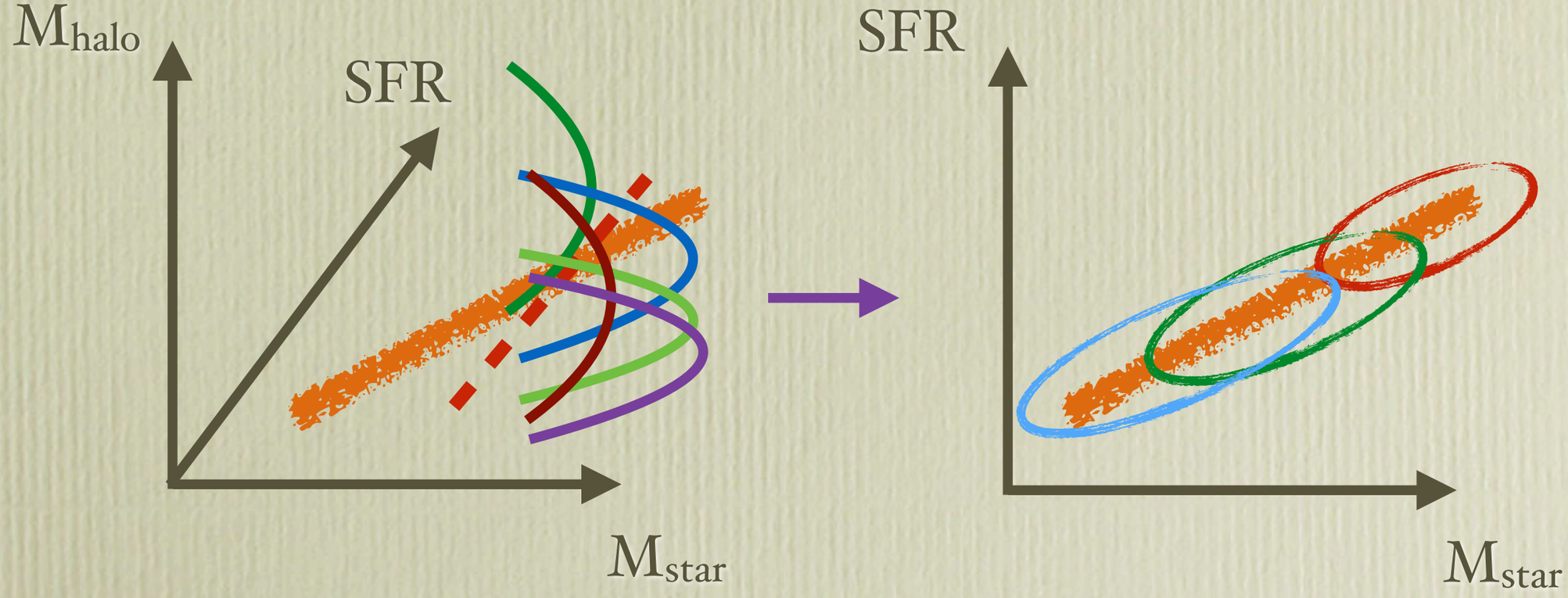




credits: M. Oguri, M. Hayashi, T. Okumura

dissecting the SF main sequence

- given a galaxy sample selected from NB, we can compute angular correlation function and infer its HOD, and, use the OL15 formalism, we can infer the halo mass pdf for a given galaxy in the sample
- we can dissect the SF MS and see how halos of different masses contribute to the MS



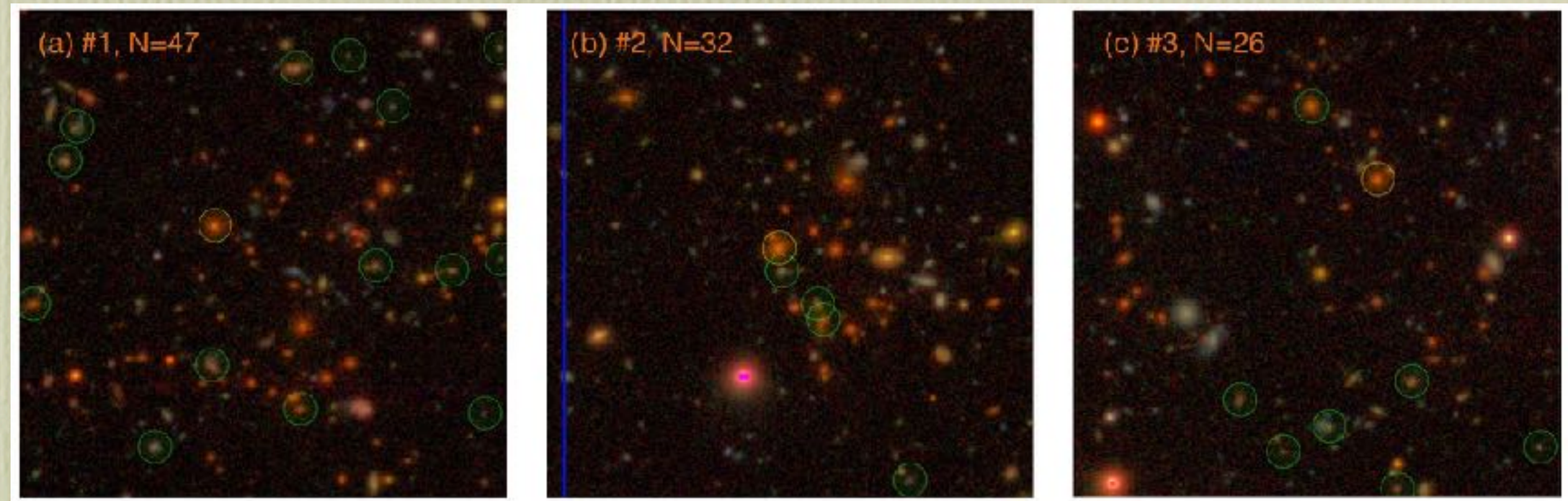
- can generalize to conditional LF or SMF

cross-correlation study of SF in groups

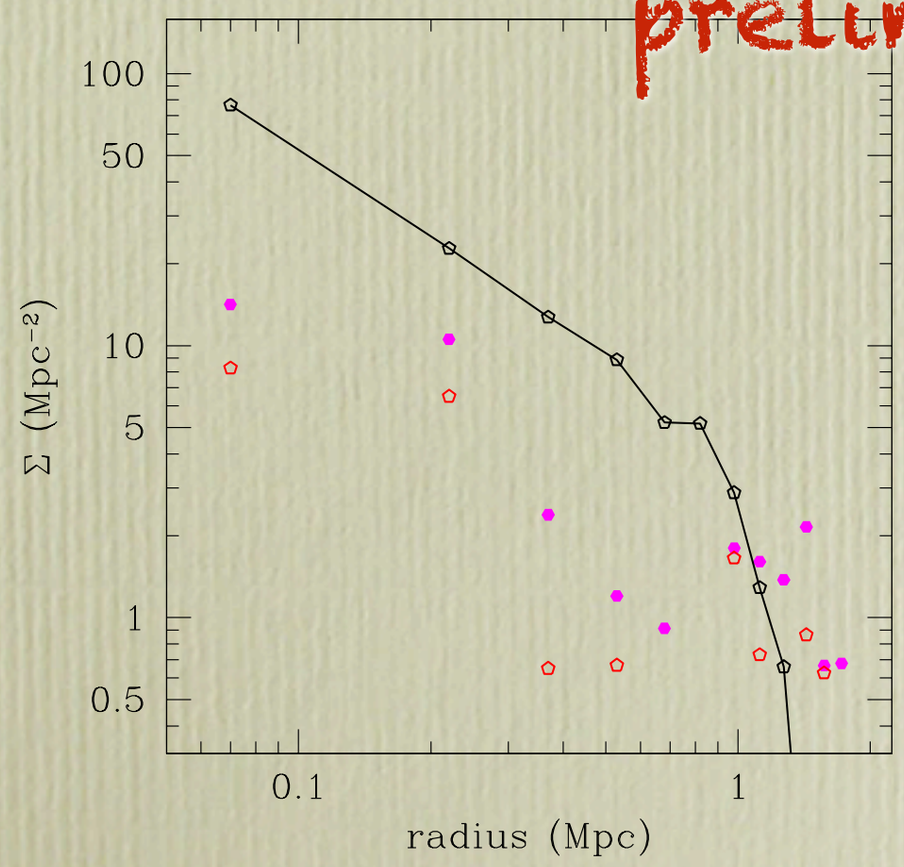
- SDSS/BOSS/eBOSS provide LRGs, from which we can define a pure central galaxy sample, which represents a sample of group-scale halos
- we can cross correlate these central galaxies with spec-z with emitters from HSC-SSP:
  - Hα at z=0.246 & 0.404
  - [OIII] at z=0.633 & 0.840

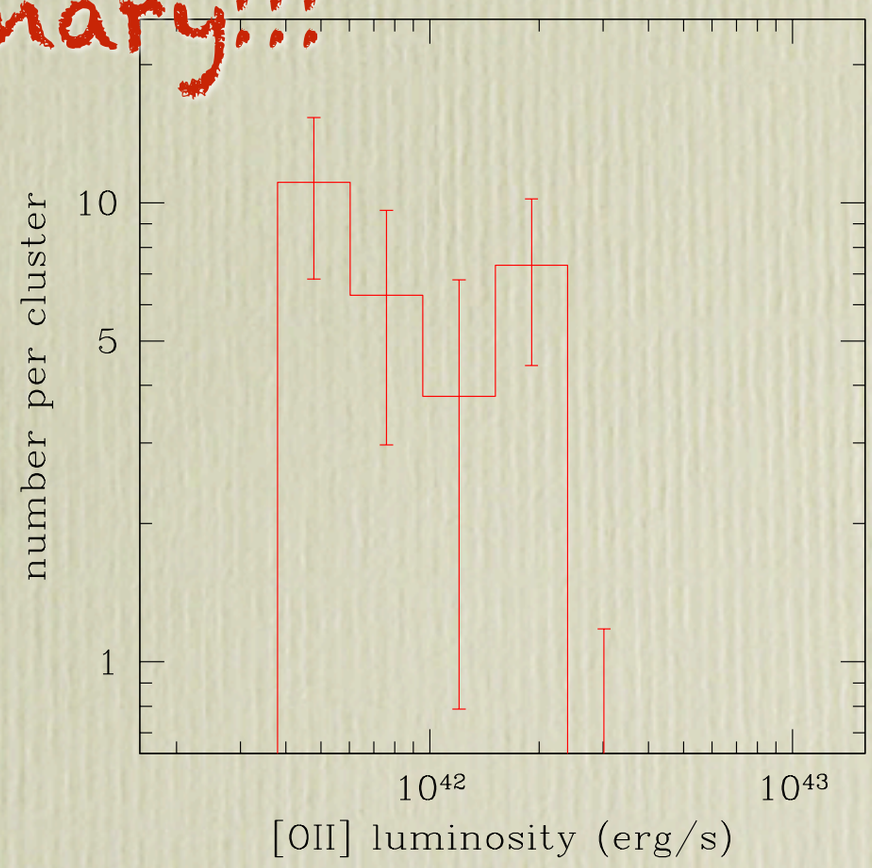
  and study the SF profiles around these groups
- this can be extended to higher-z by using central galaxies from PFS galaxy evolution survey, and emitters from NB data of HSC-SSP & ULTIMATE
  - [OII] at z=1.19 & 1.47

cross-correlation study of SF in clusters



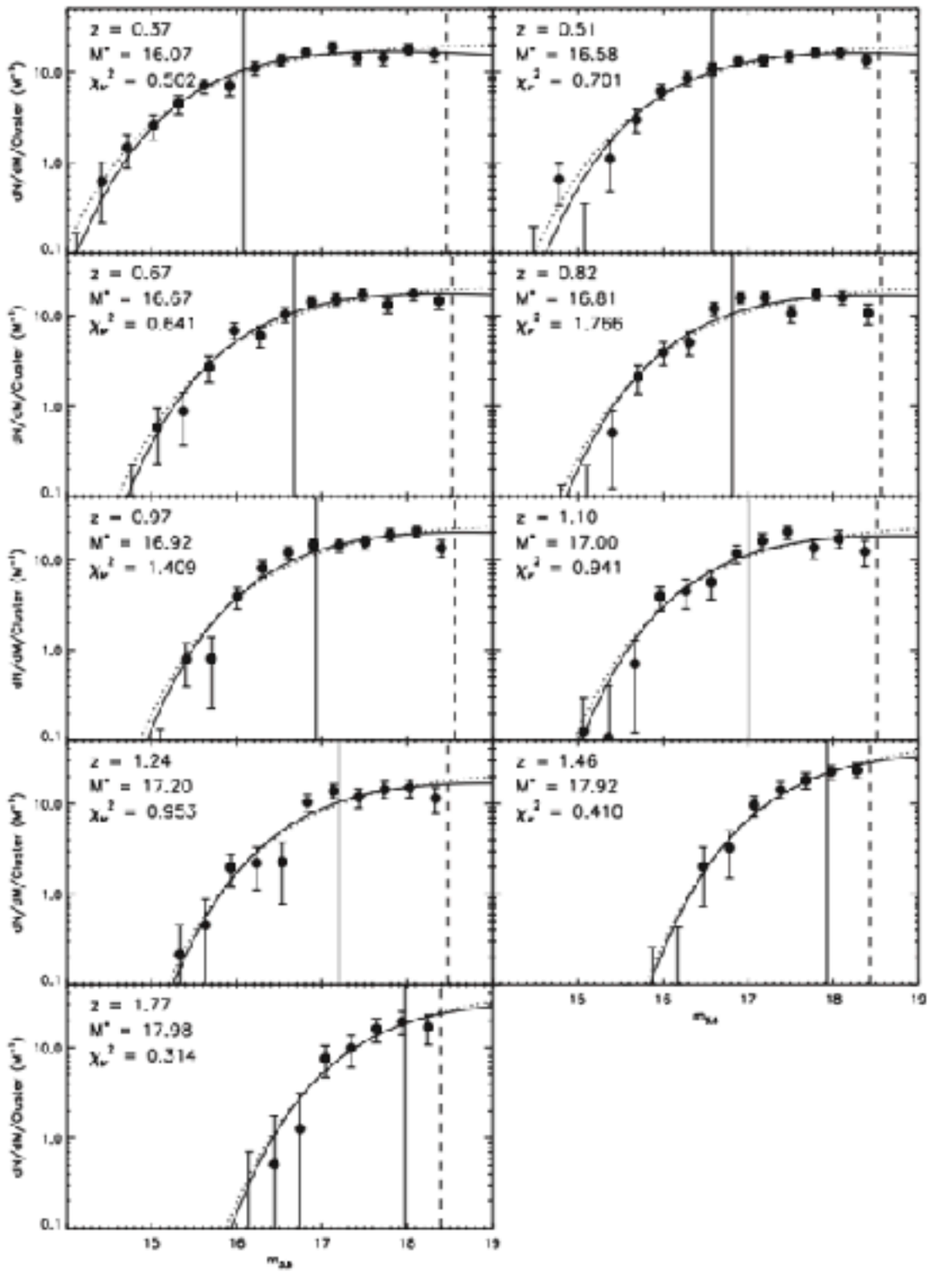
preliminary!!!

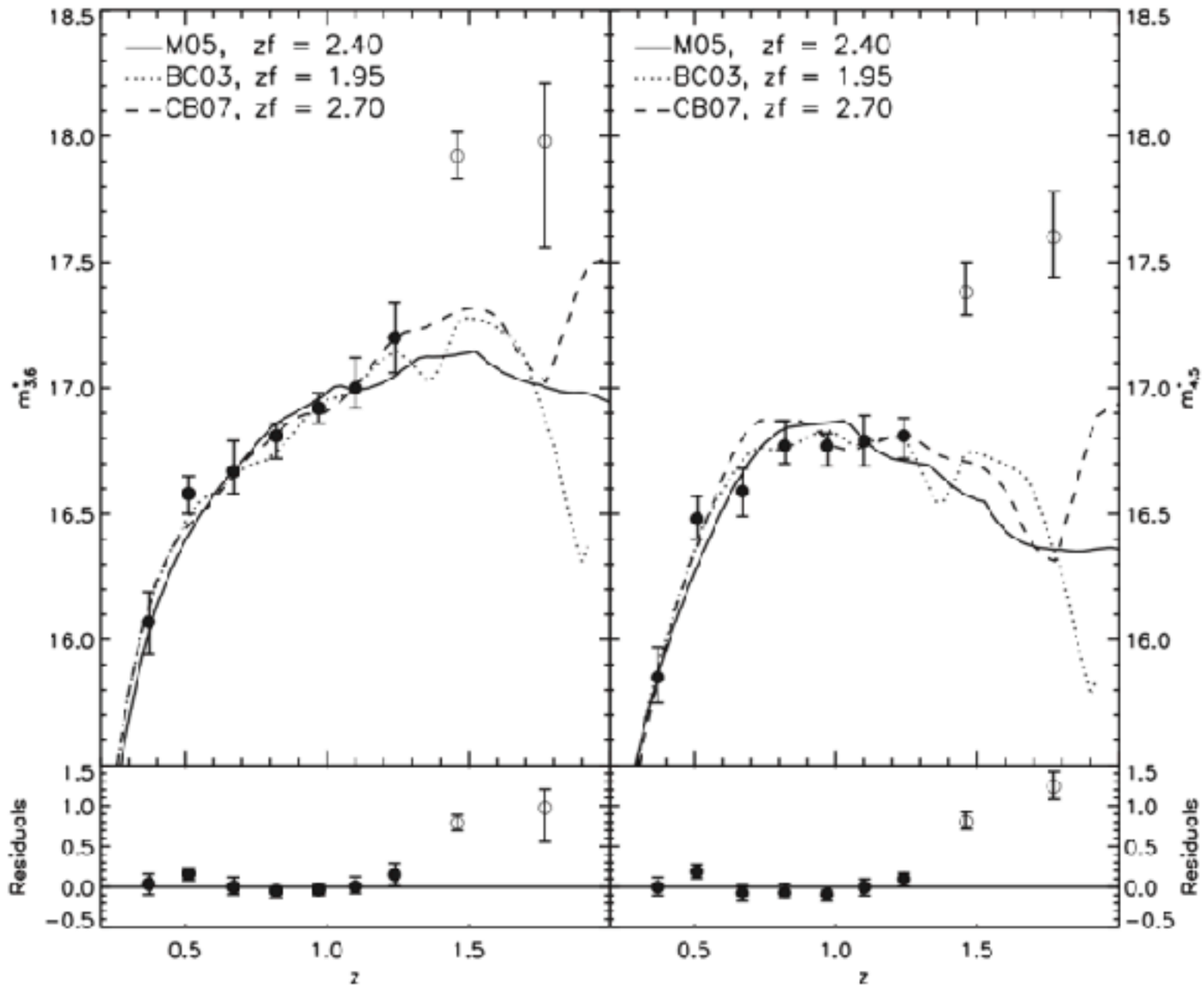




evolution of cluster galaxy LF

z>1.5: epoch of the buildup of BCG & majority of cluster galaxies?

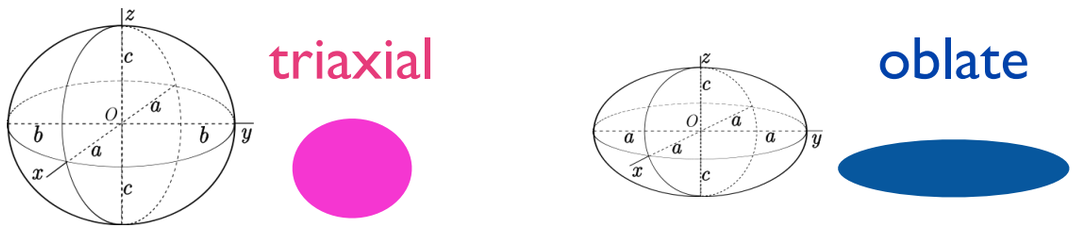




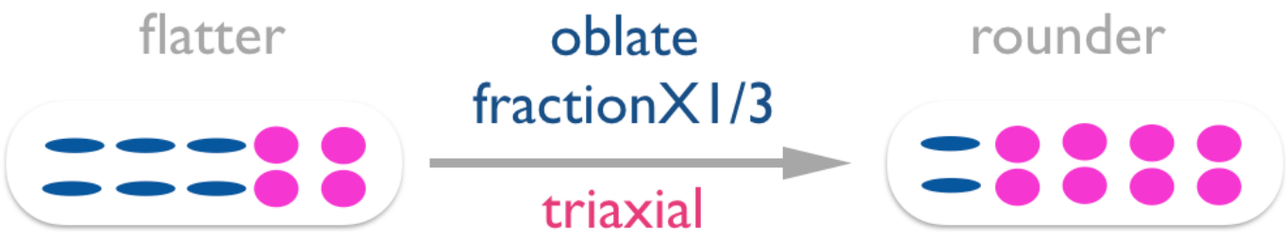
mancone+10

Galaxies in 3D at z~2

- Intrinsic shapes
  - The majority of massive quiescent galaxies at z~2 are disk-like.
  - Star-forming galaxies with M_*~10^{10} $M_\odot$ are a mix of equal numbers of elongated and disk galaxies at z~2
  - Majority of stars formed in disks.
  - Large ellipticals can be form through galaxy mergers.



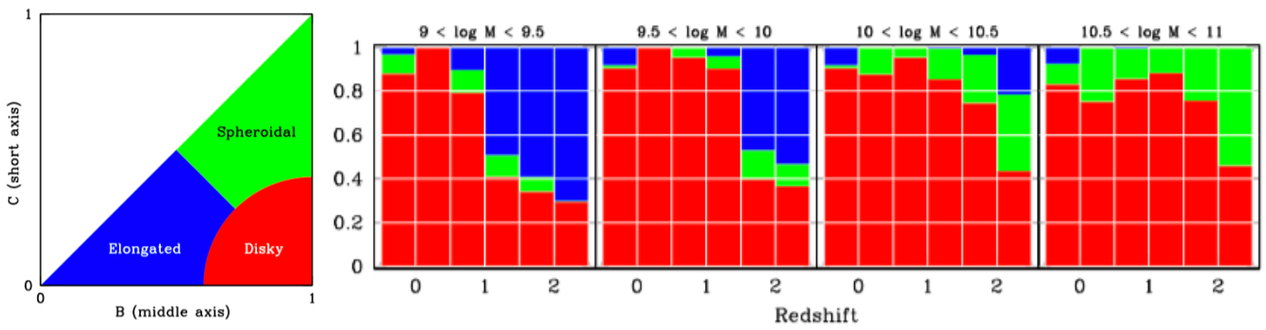
Quiescent Galaxies



Chang+13ab

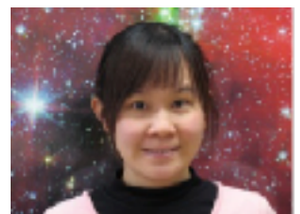
- ULTIMATE-Subaru
  - The wide coverage will be able to provide a very large sample to truly reconstruct the intrinsic shapes of galaxies at z~2
  - Subsamples are possible:
    - Different environments.
    - AGN host galaxies.

Star-forming Galaxies



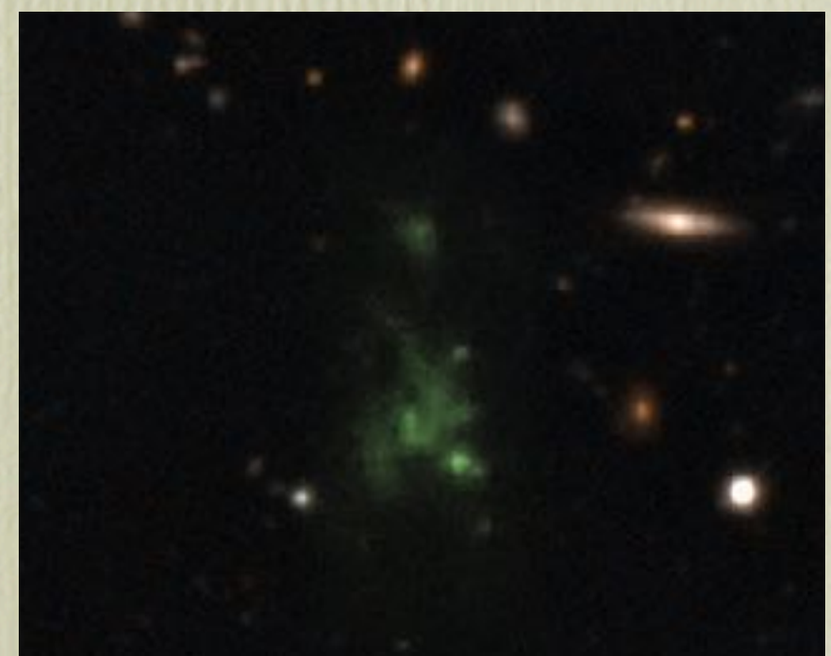
vdW, Chang+14b

Yu-Yen Chang



Y. Ohyama: lighting up LABs

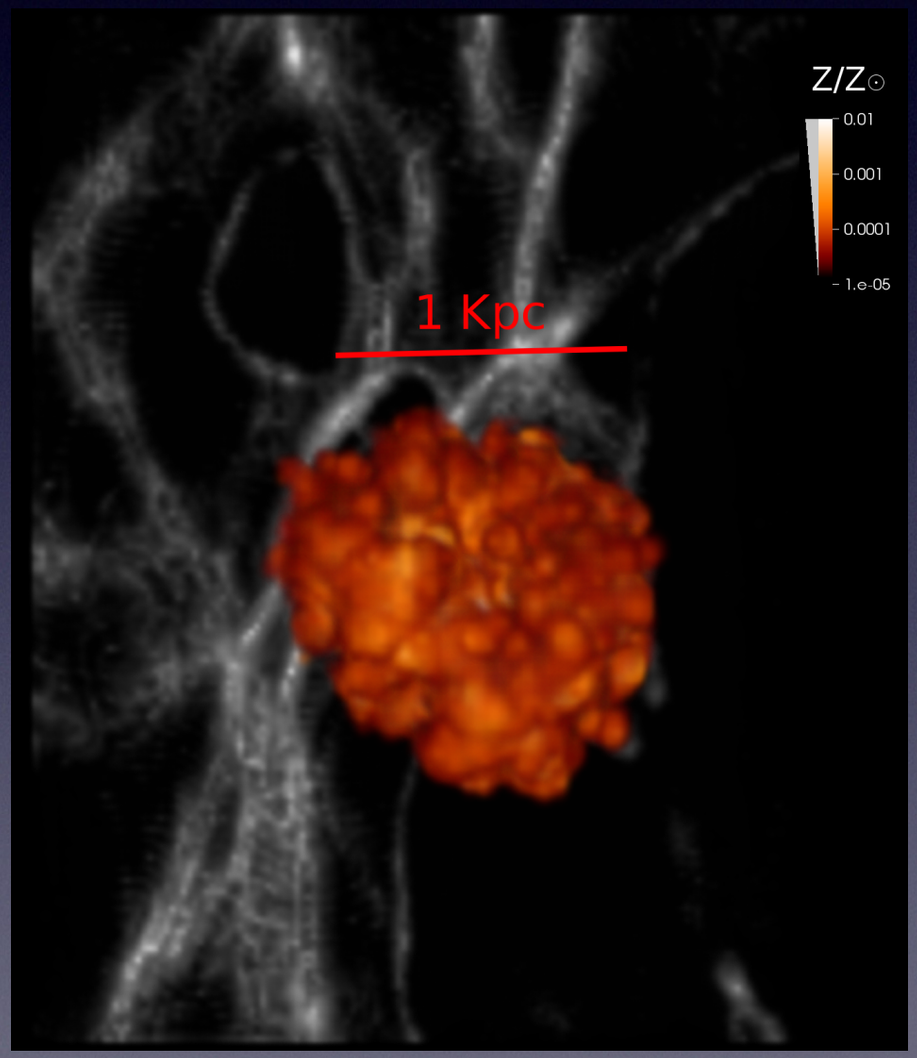
- the nature of Lyman α blobs (LABs) is still not well-understood
- they might be caused by superwinds from dust enshrouded star forming/active galaxies
- investigating in details the gas kinematics & line excitation diagnostics (from Hβ, [OIII], Hα, [NII]) of LABs and surrounding galaxies may provide invaluable insights into the physical processes (shocks/photo-ionization/inflow/outflow)
- could observe known overdense regions at z~2-3 with multiple IFUs of ULTIMATE, targeting SMGs/ULIRGs/AGNs and their neighbors



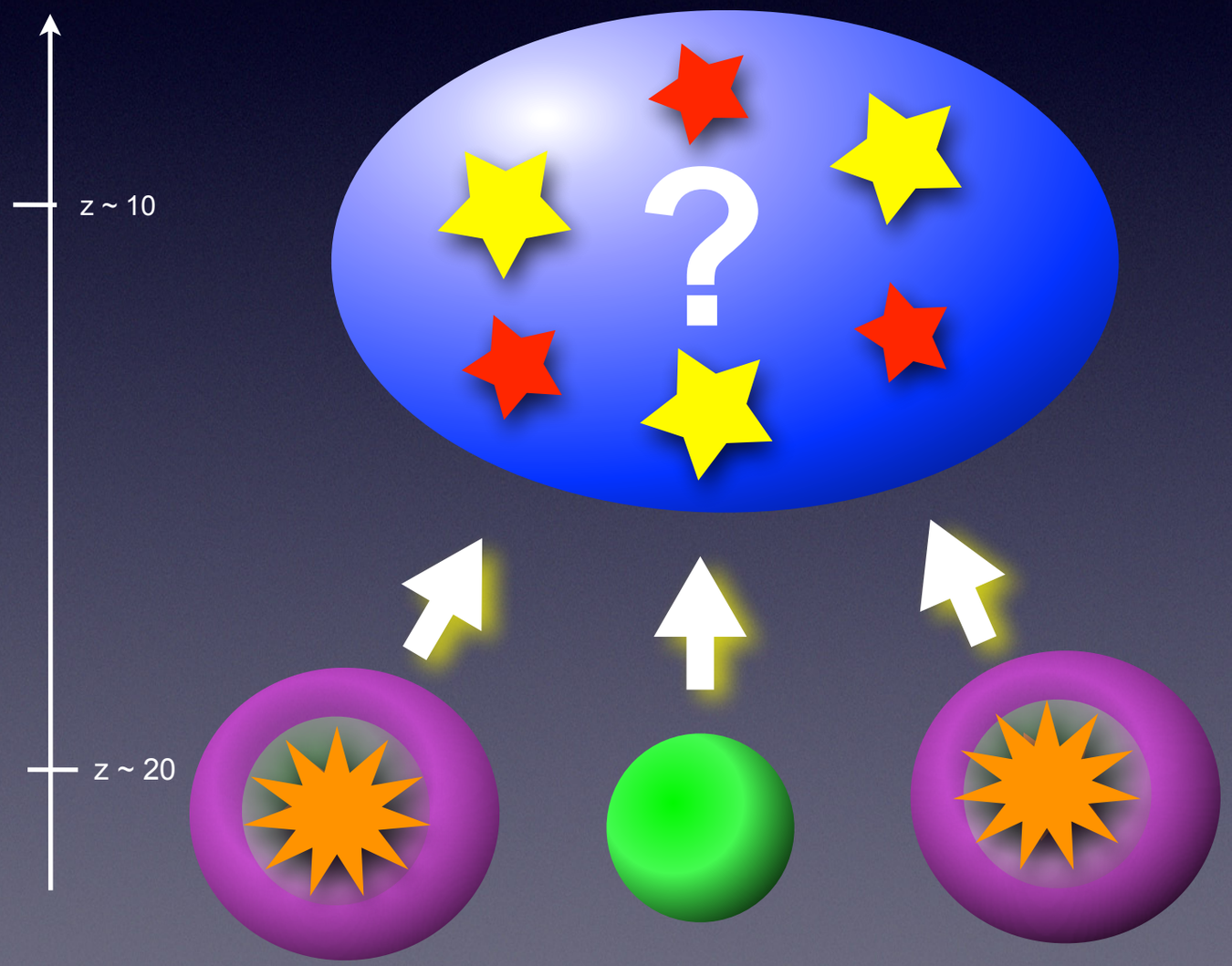
Ken Chen

The First Supernovae and Galaxies

Our goal is to understand how the first stellar feedback affected the formation of the first galaxies by carrying out sophisticated cosmological simulations and to provide predictions for the observational signatures to be observed by the Ultimate Subaru.



Chemical enrichment of the first Supernovae



How did the first galaxies form?

Chen+ ApJ 802 13 (2015), Chen+ MNRAS 467 4731(2017), Chen+ ApJ 844 111 (2017)

ideas

- finding the oldest, metal poor brown dwarves (NB)
- evolution of the star formation and LI(N)ER sequences (IFU)
- quenching of galactic star formation (IFU)
- inferring dark matter halo mass from neighboring galaxy counts: application to star formation activity in groups and clusters; dissecting the SF main sequence (NB)
- cluster galaxy evolution (NB+BB)
- galaxy 3D shapes (BB)
- Lyman alpha blobs (IFU)
- first galaxies (NB)
- ...