Study of Lyα Blobs at z = 4.9, 6.6, and 7.0

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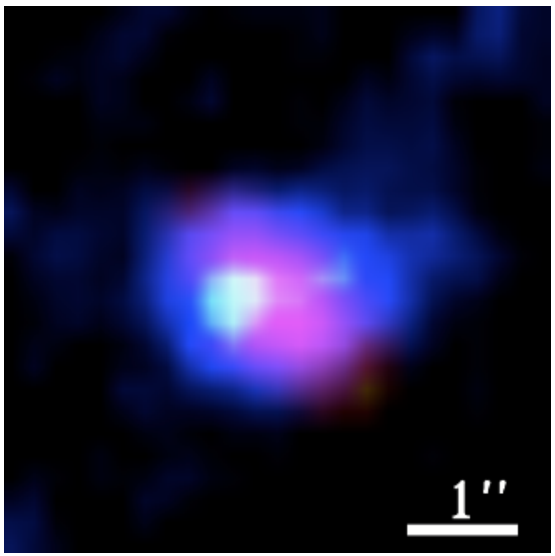
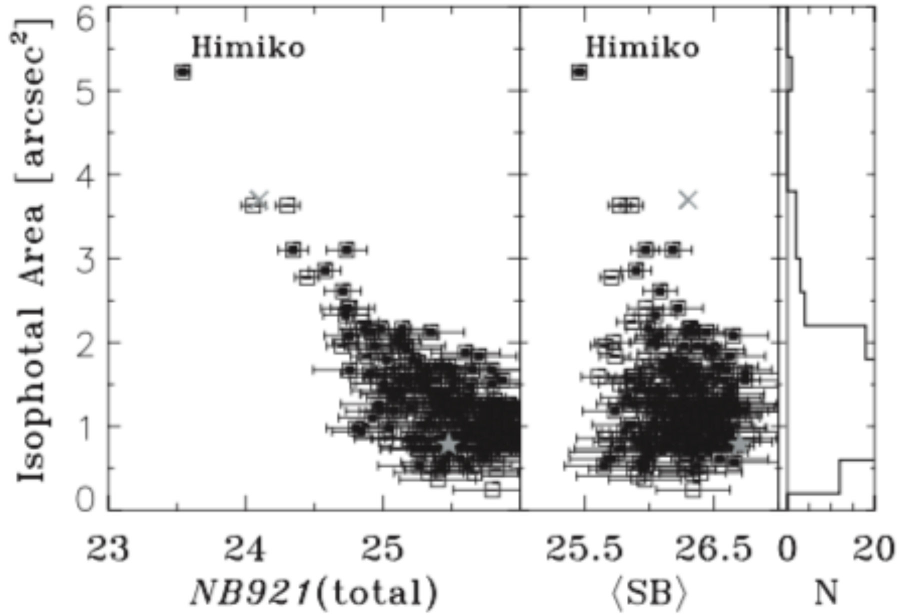
1. Introduction

- Lyα blobs (LABs) are rare giants among LAEs.



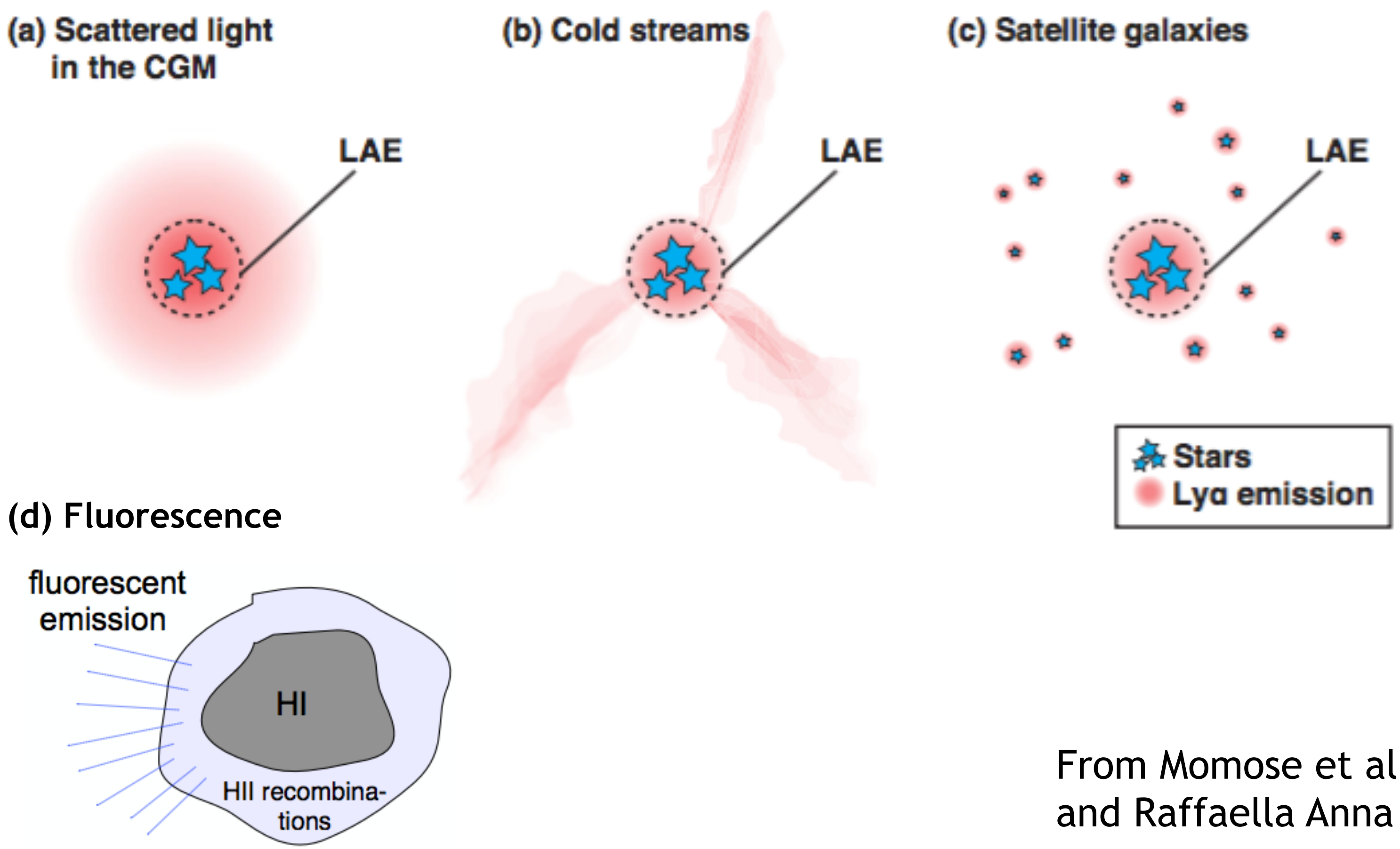
Himiko[a]



- Are LABs different from normal (non-LAB) LAEs <u>besides</u> bright Lyα luminosities and large sizes?

[a] Ouchi et al. (2009)

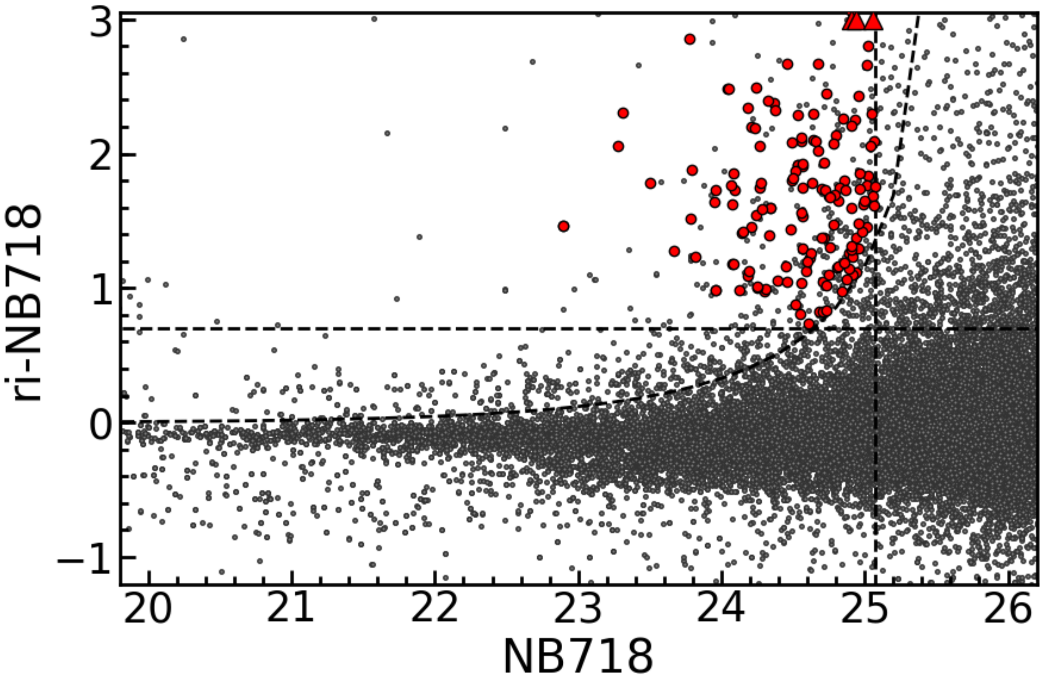
- What is the physical origin of extended Lyα emission around LABs?



From Momose et al. (2016) and Raffaella Anna Marino

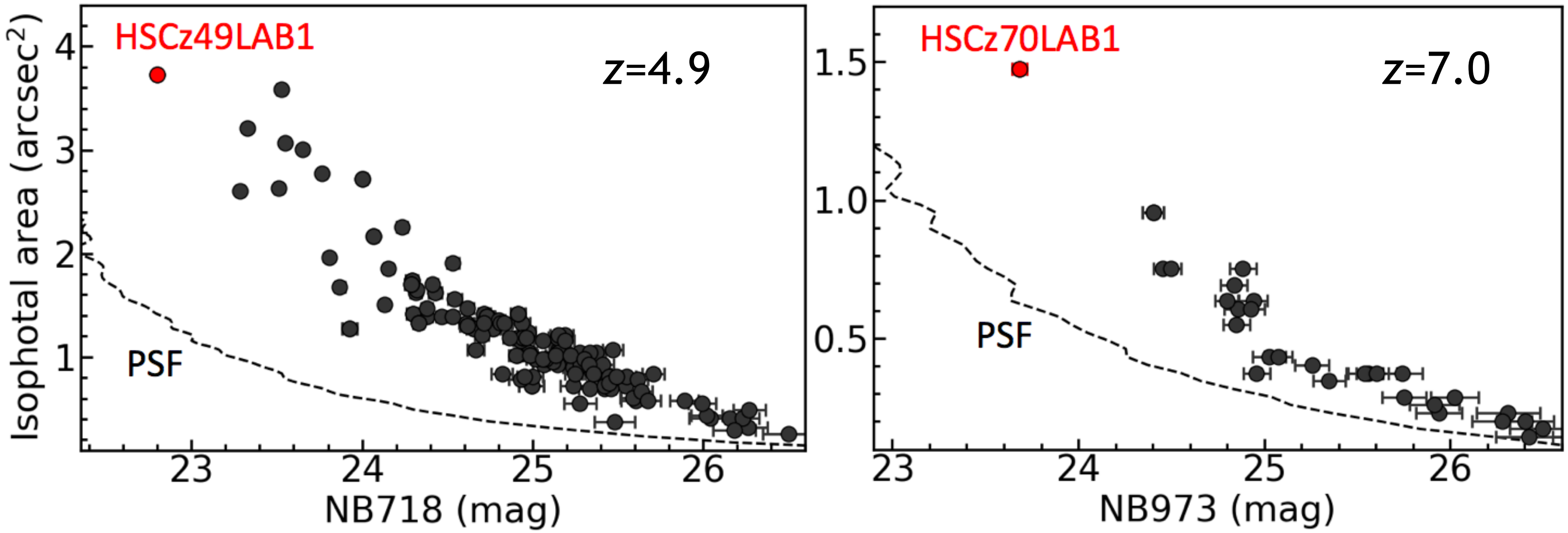
2. Data

- CHORUS narrowband NB718 is used to select 141 LAE candidates at z = 4.9.



- We use 34 LAE candidates at z = 7.0 selected by Itoh et al. (2018).

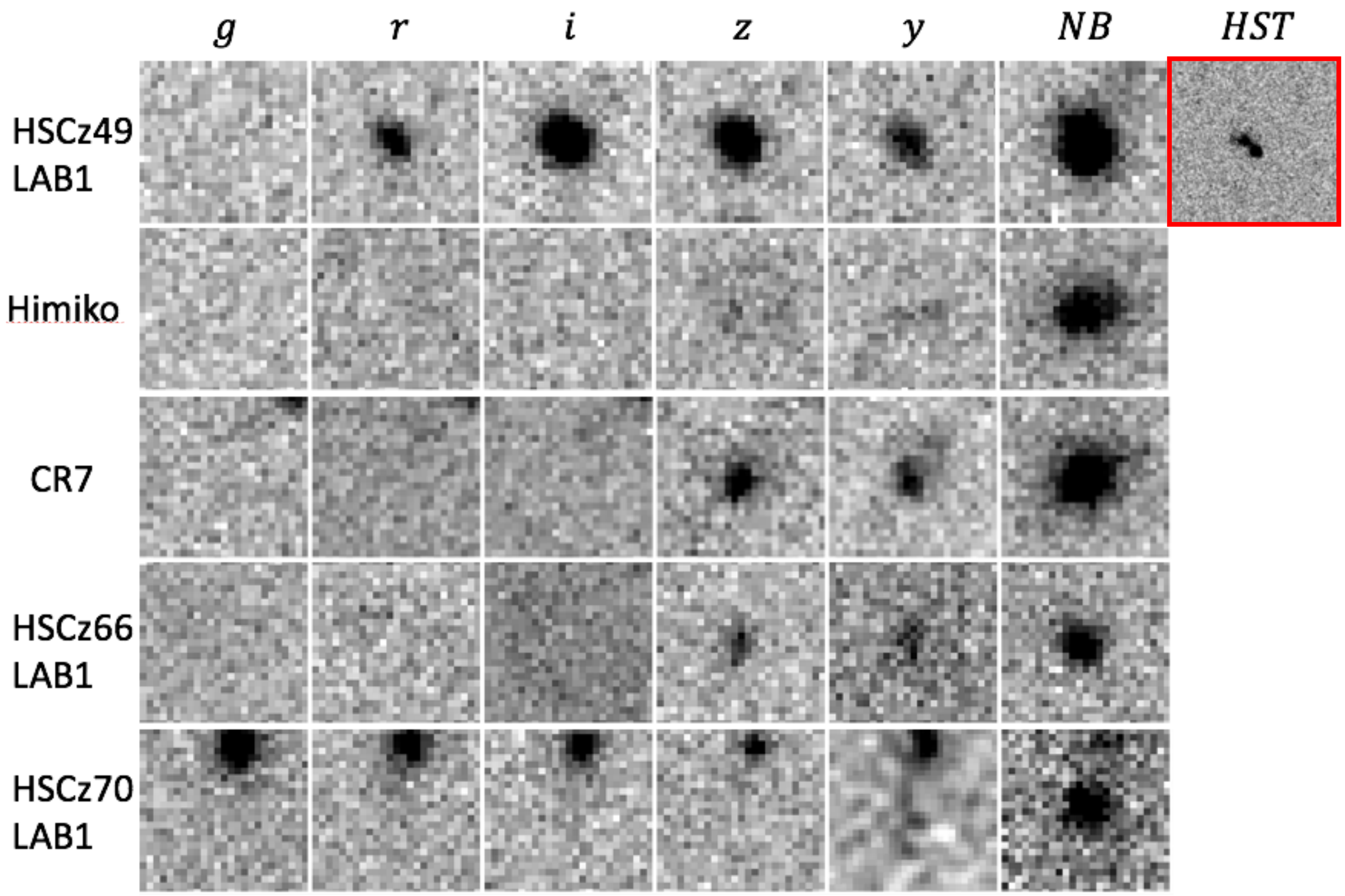
- Photometric identification of two LABs at z=4.9 and 7.0: HSCz49LAB1 and HSCz70LAB1.



- Three LABs at z=6.6 from previous studies: Himiko[a], CR7[b], and HSCz66LAB1[c]. In total, we have 5 LABs.
- Spectroscopic data are available except HSCz70LAB1.

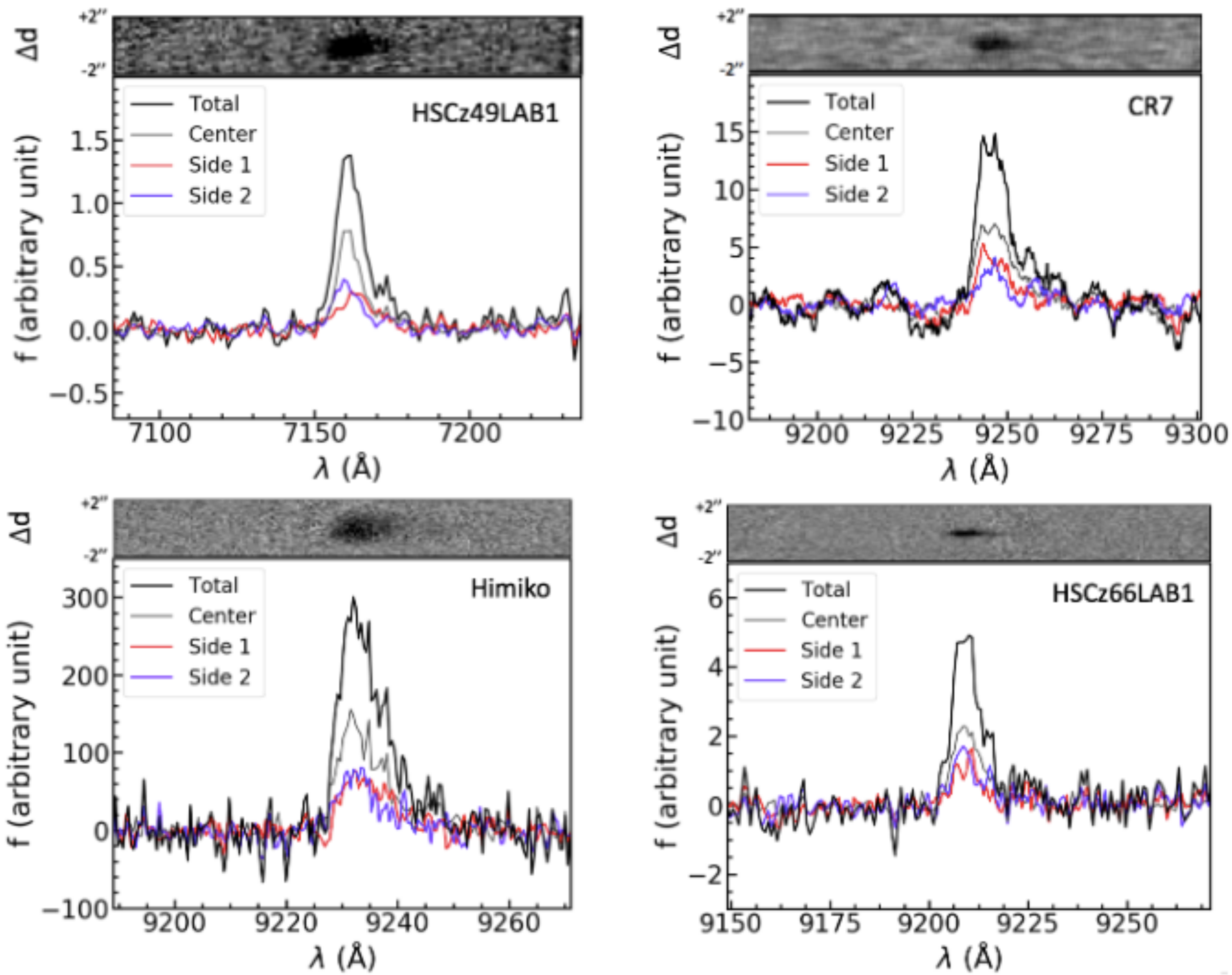
[a] Ouchi et al. (2009)
[b] Sobral et al. (2015)
[c] Shibuya et al. (2017a)

- Two components of HSCz49LAB1 are found in HST F814W image: possible merger.



3. Results

3.1 Decomposed spectra: flux in center, side 1 , and side 2 = 50%, 25%, and 25% of total flux.



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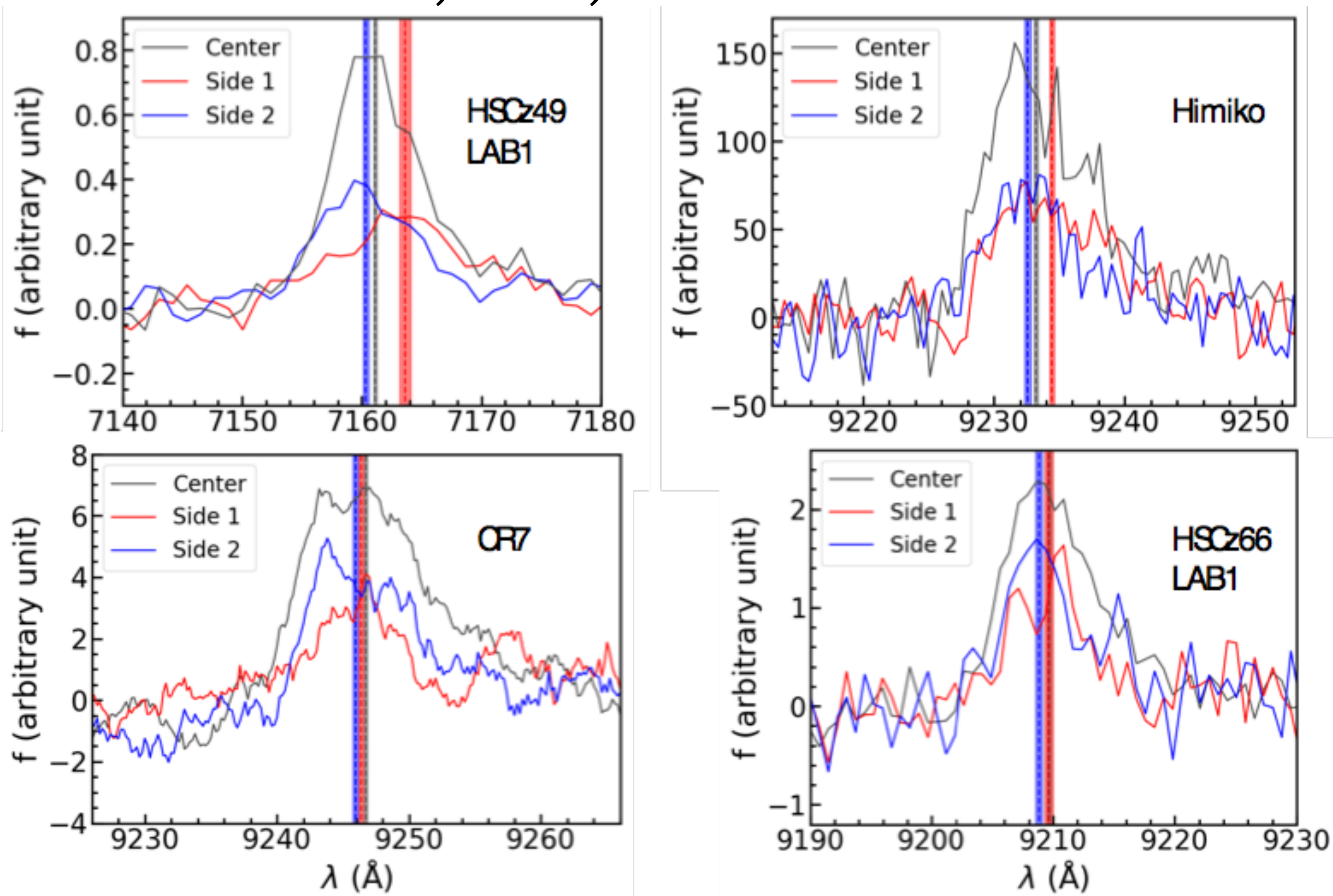
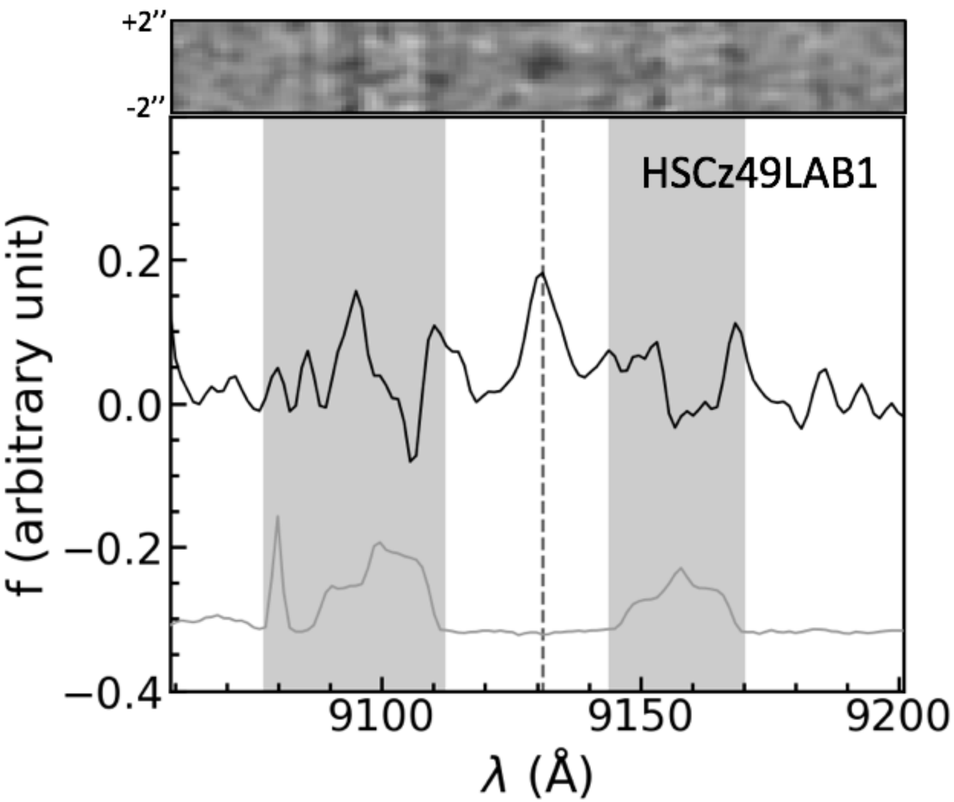
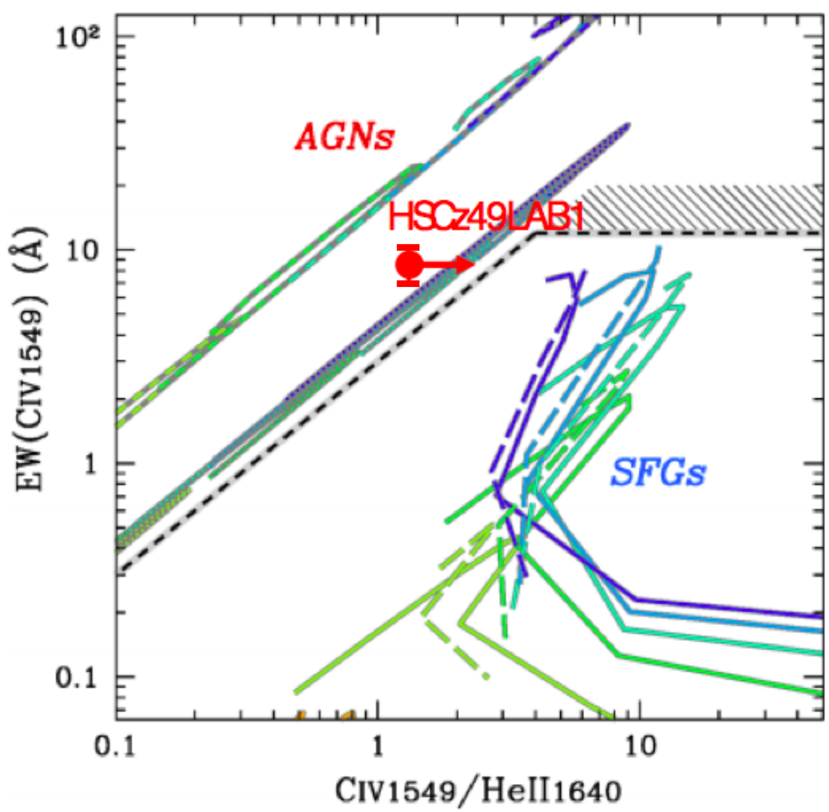


- HSCz49LAB1 has CIV but no He II emission.

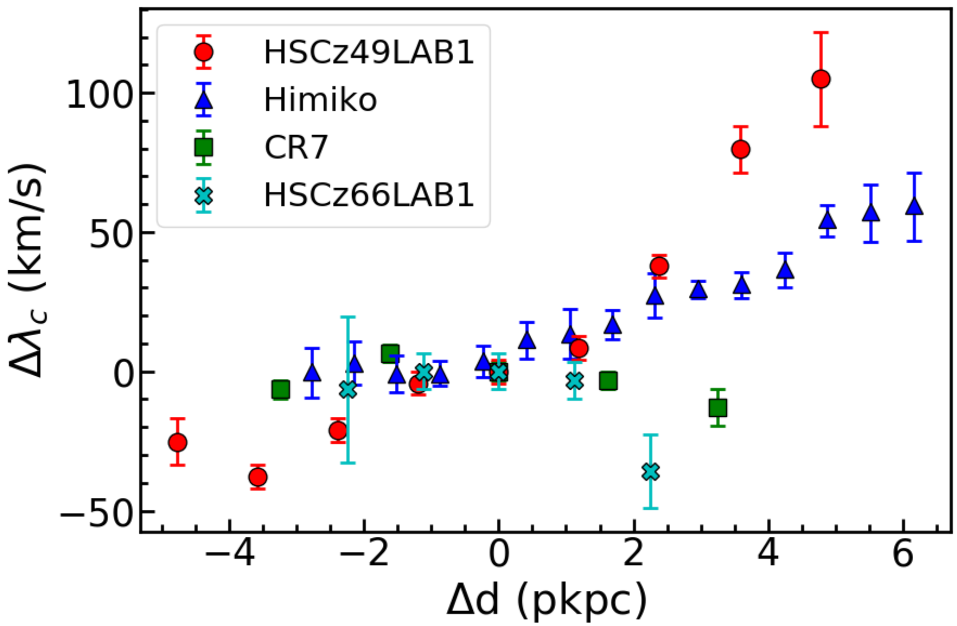
  -> HSCz49LAB1 is an AGN, or a very young and metal poor SFG.

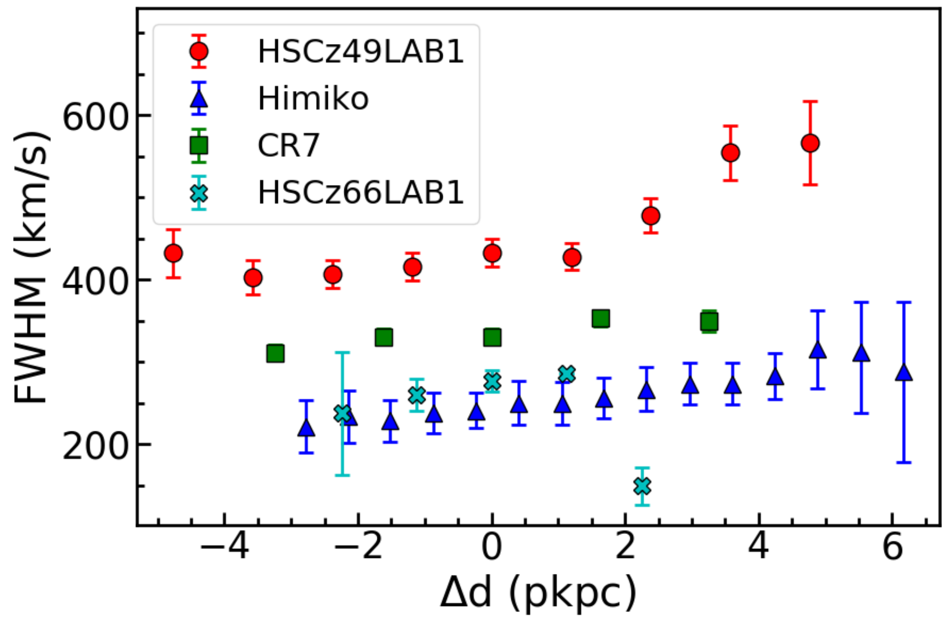




Nakajima et al. (2018)

- Quantify the LABs’ spectra:

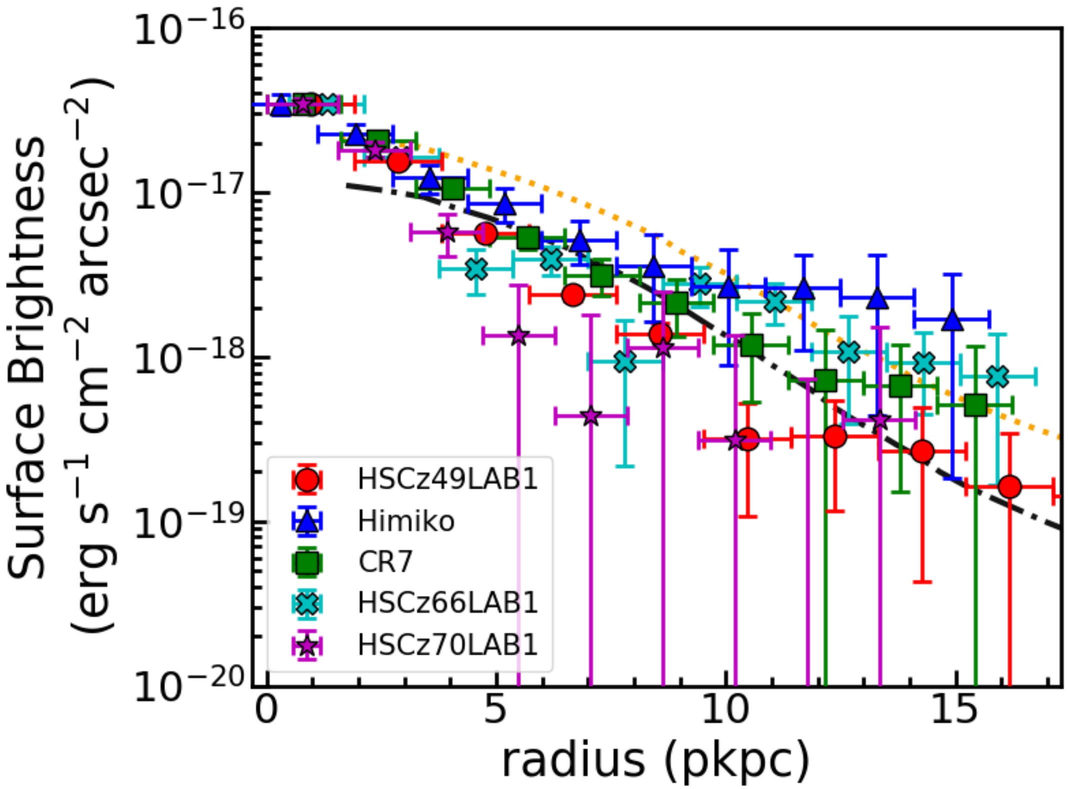




- HSCz49LAB1 shows a larger line-center offset $\Delta\lambda_c$ and FWHM.

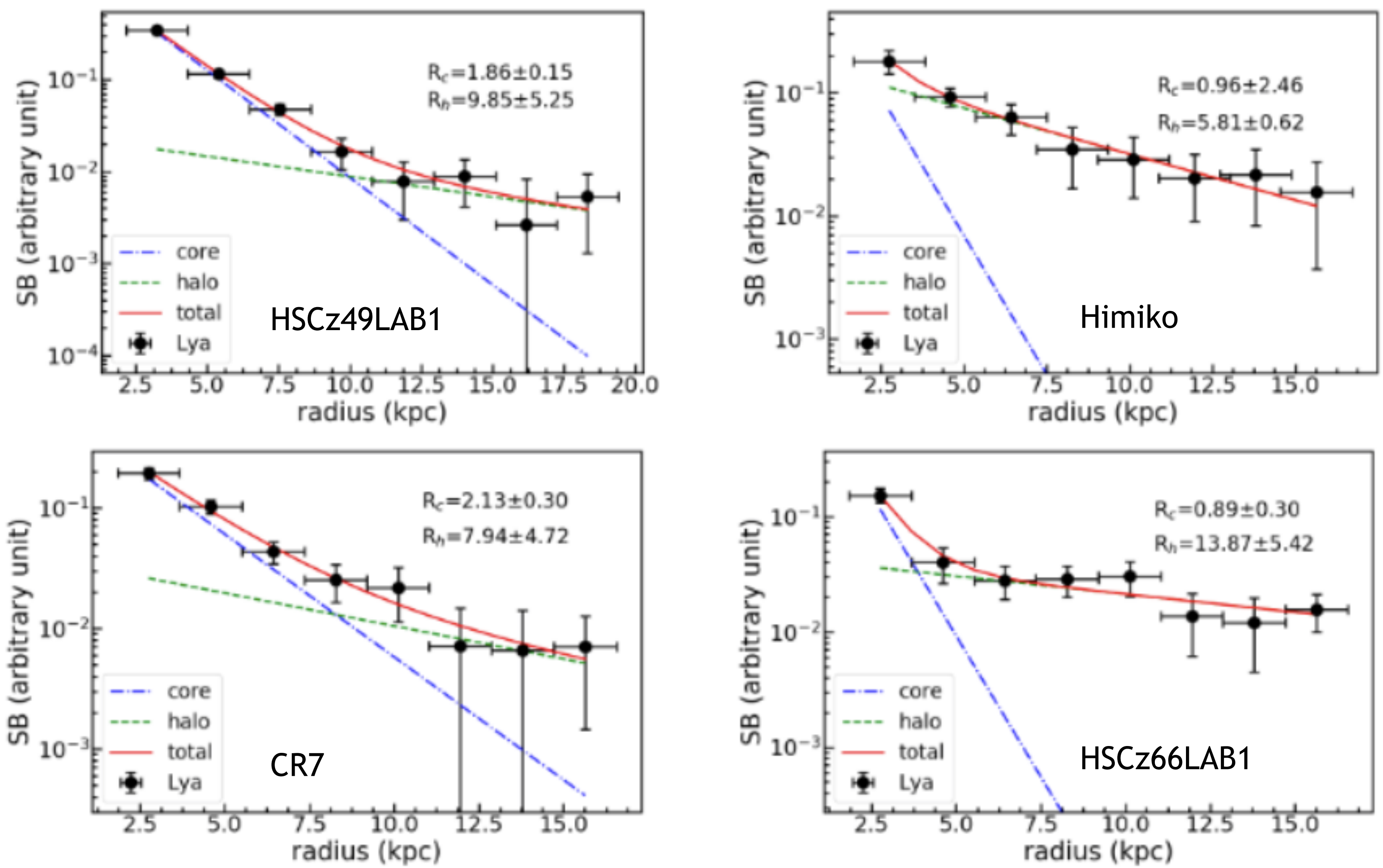
  -> larger rotation velocity, stronger outflow, and/or higher H_I density in CGM caused by AGN or merger.

3.2 Lyα surface brightness (SB) profiles of the 5 LABs:



- Star-forming (yellow) and cooling (black) models for normal LAEs at <u>z=3.1</u> cannot explain high-z LABs.

- Two-component fitting of SB profiles to measure halo scale length r_{halo}:

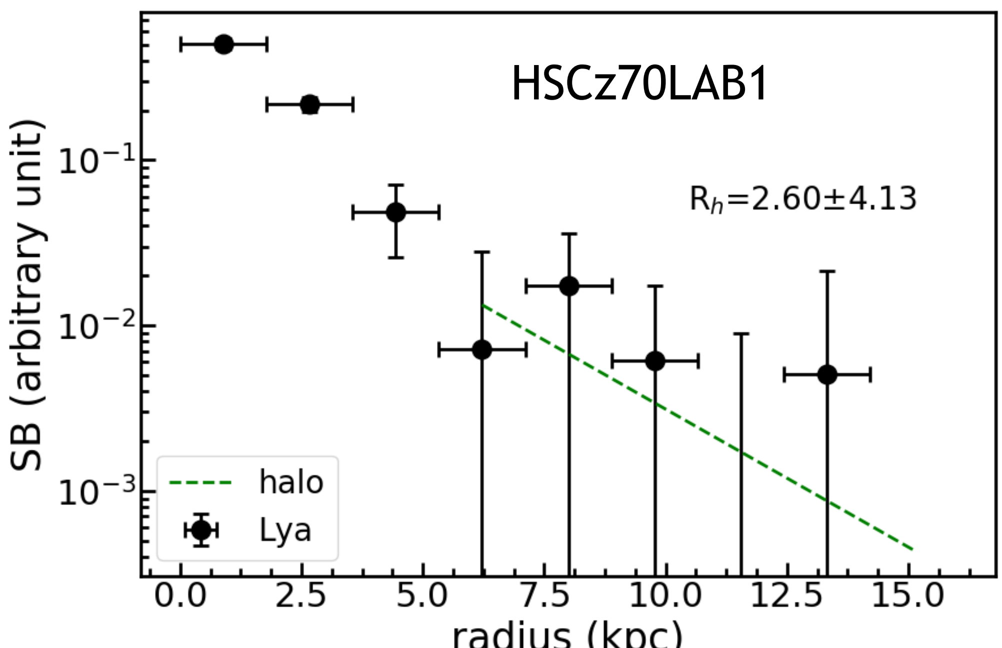


- Two-component fitting formula:

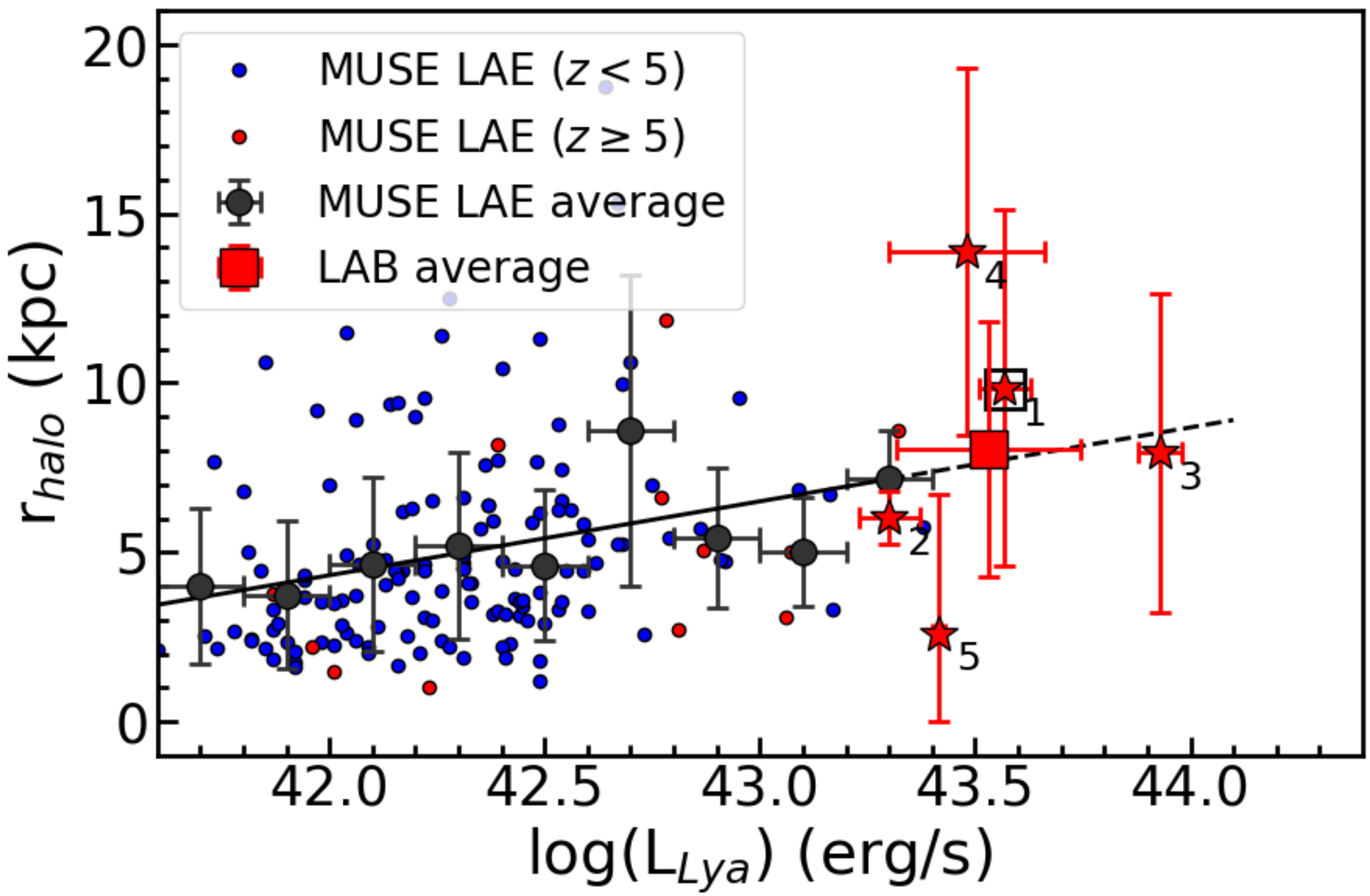
$$S_{cont}(r) = A_1 \exp(-r/r_{core}) \text{ and}$$
$$S_{Ly\alpha}(r) = A_2 \exp(-r/r_{core}) + A_3 \exp(-r/r_{halo})$$

- One-component fitting for HSCz70LAB1 due to unresolved UV continuum:

$$S_{Ly\alpha}(r) = A_3 \exp(-r/r_{halo})$$



3.3 Halo scale length comparison between LABs and normal MUSE LAEs[a]:



[a] Leclercq et al. (2017)

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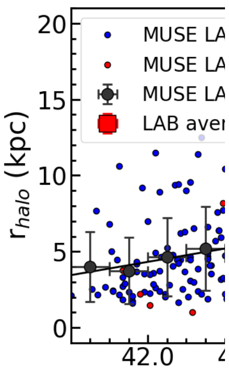

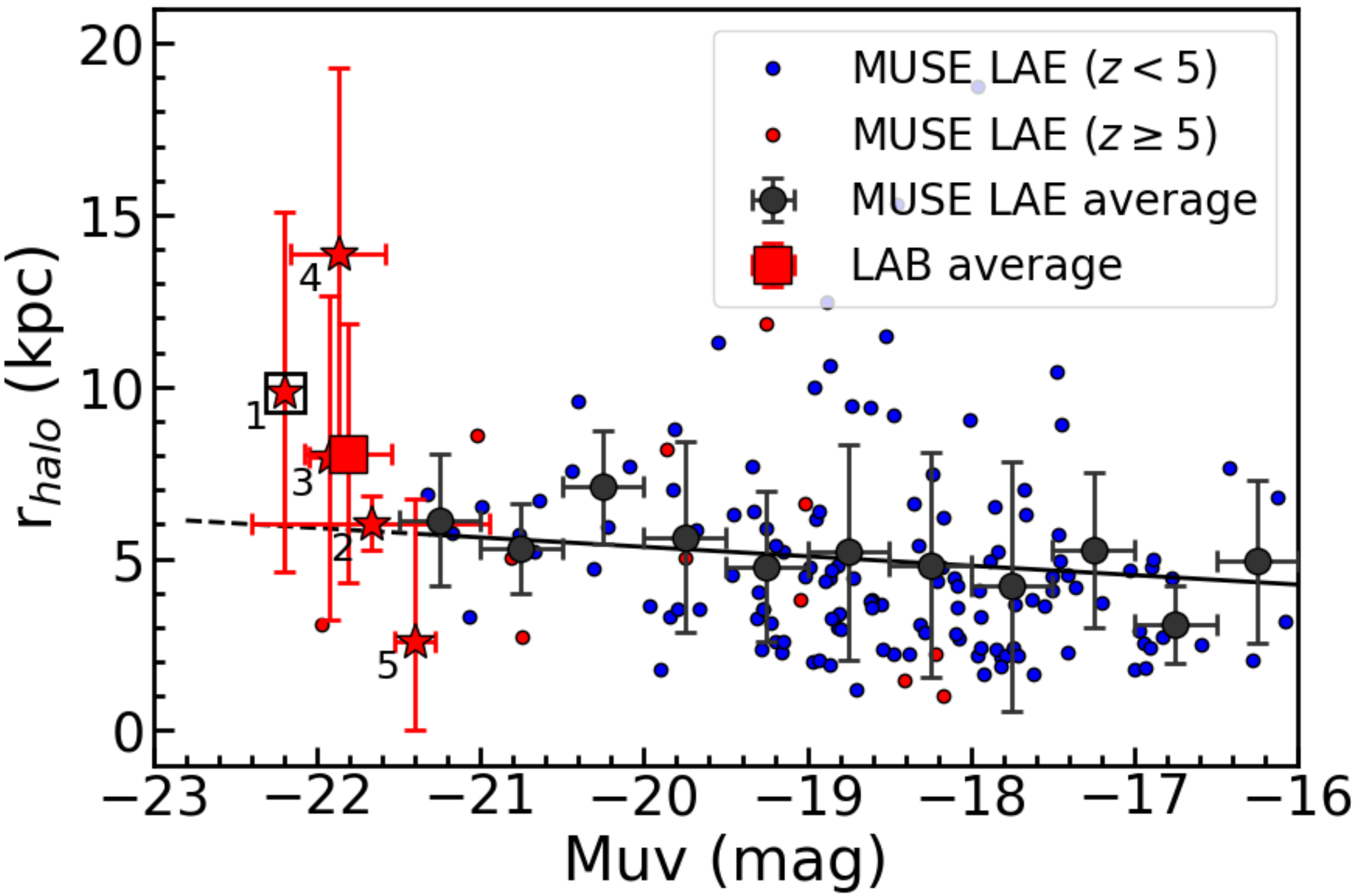

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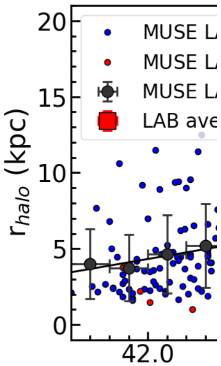

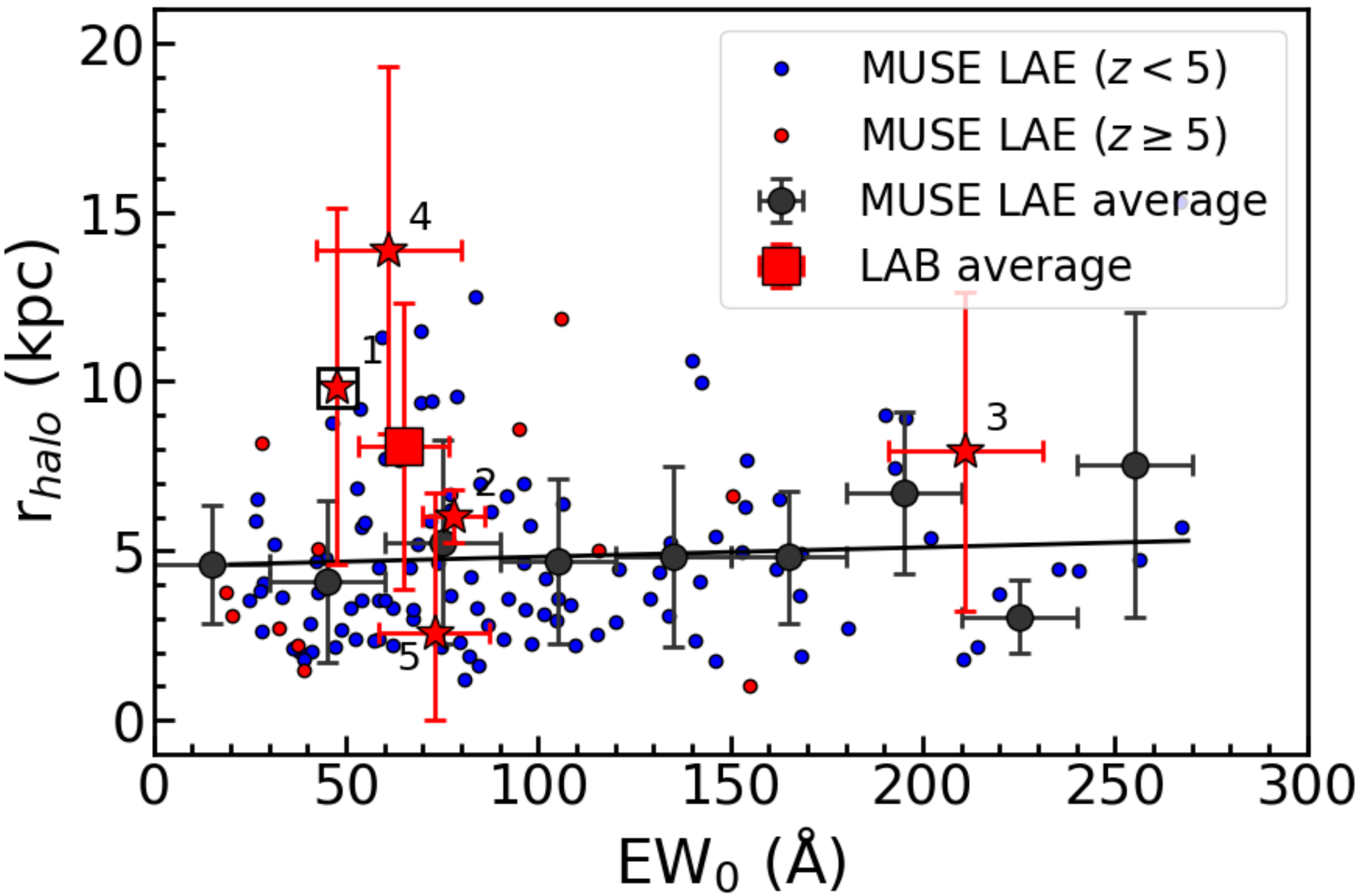

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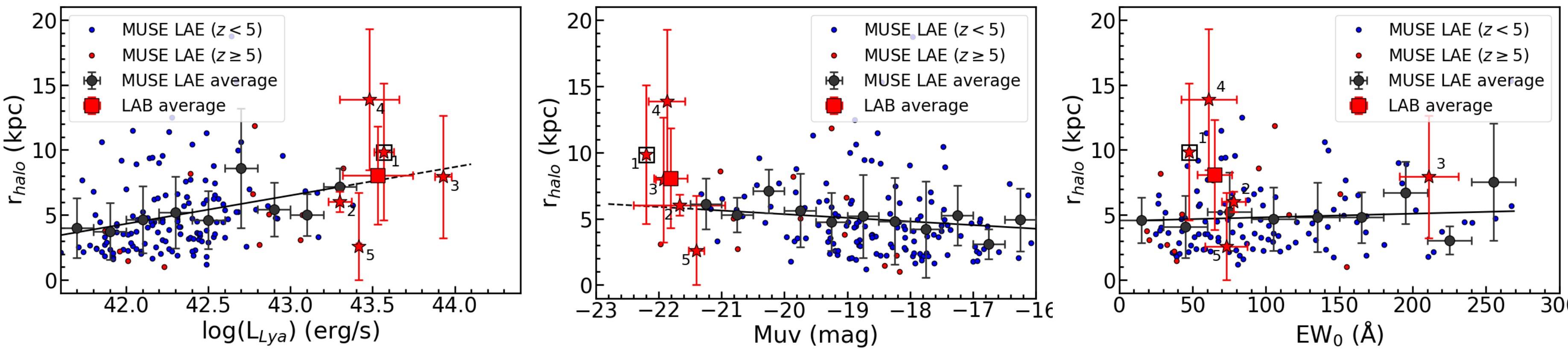
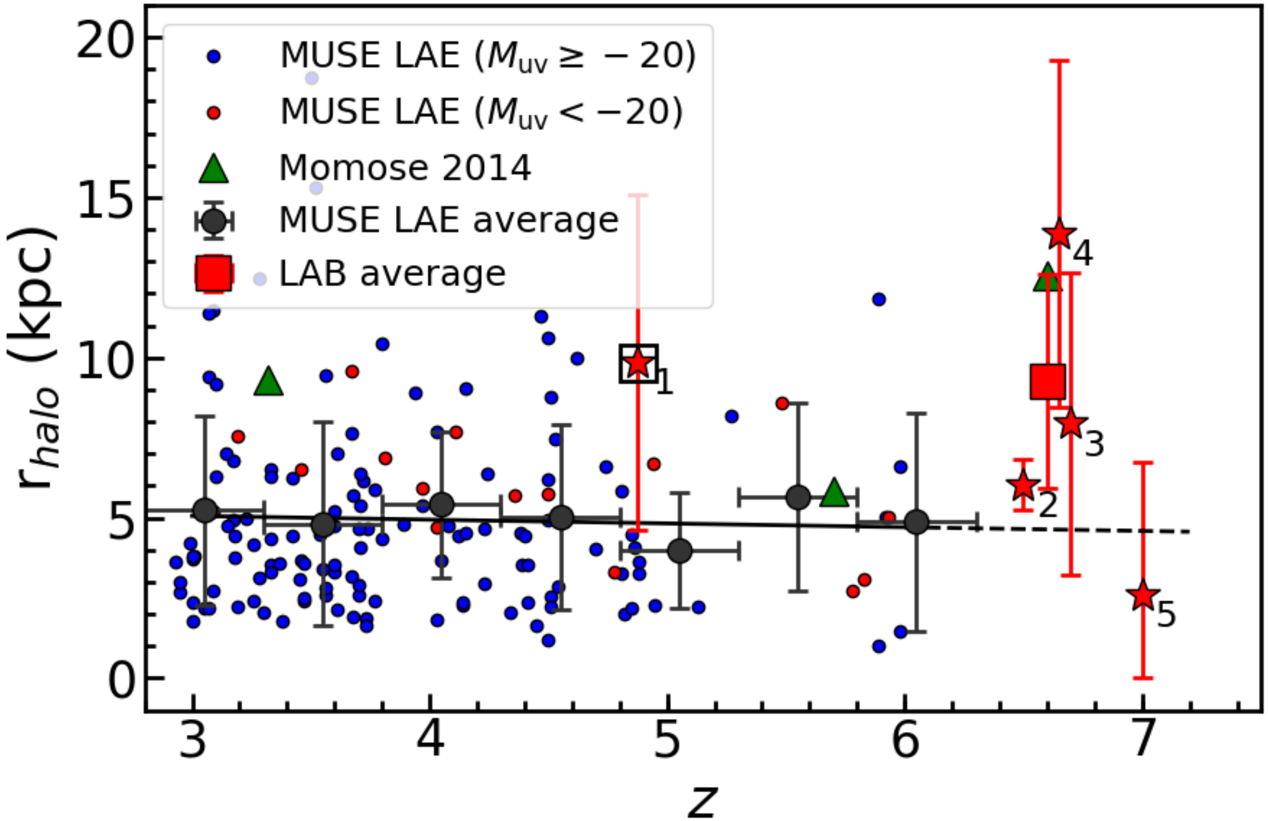


- The r_{halo} of LABs is consistent with the extrapolation of the average of MUSE LAEs.

  -> Similar physical origin of extended Lyα emission.

[a] Leclercq et al. (2017)

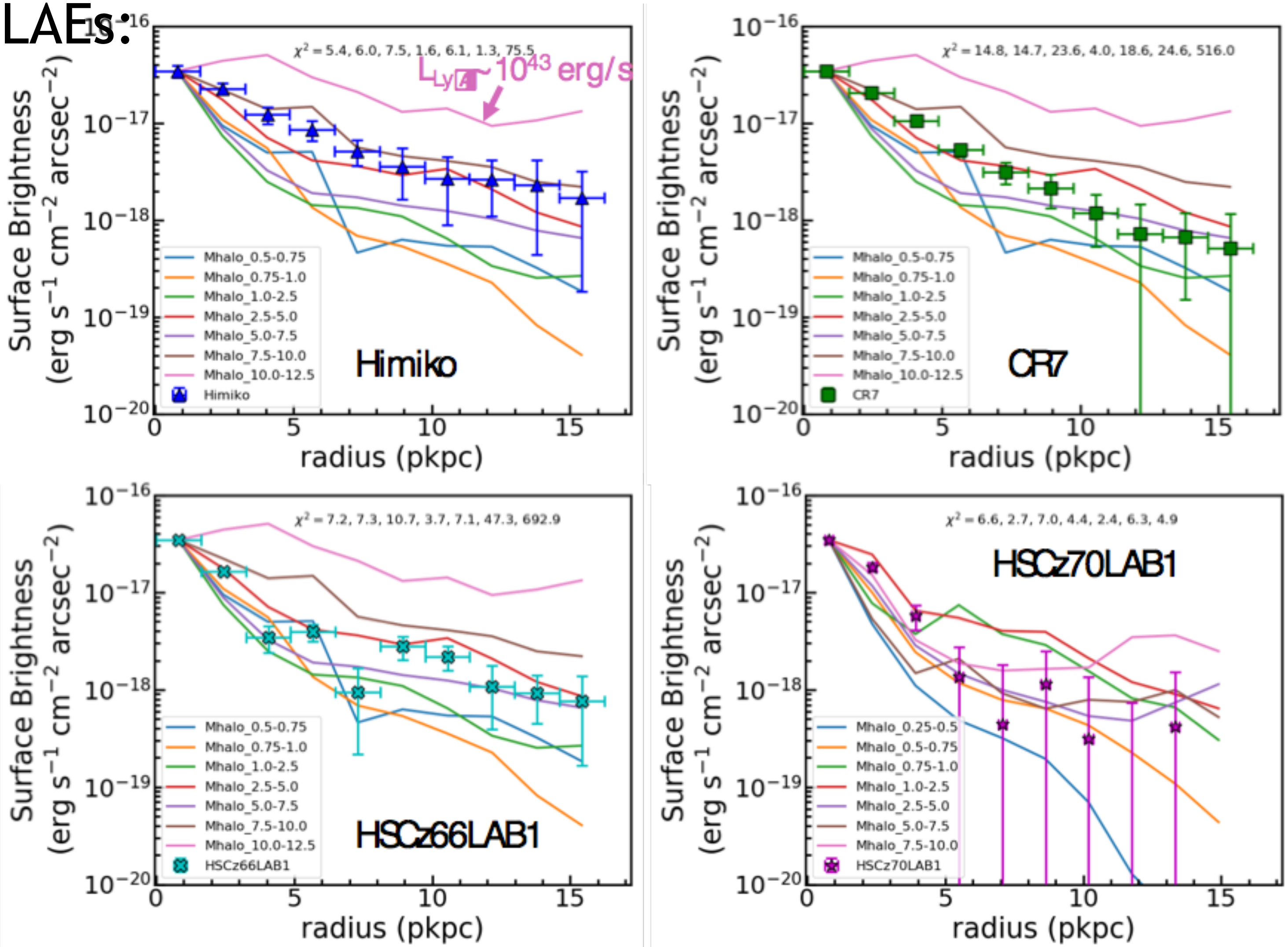


- Consistent with results from MUSE and Momose.
- The r_{halo} of LABs at different z is similar.

  -> CGM around LABs does not evolve significantly between z=4.9 and 7.0.

3.4 Physical origins of extended Lyα emission of LABs

- A radiative transfer model (Abe et al. 2018) for high-z LAEs:



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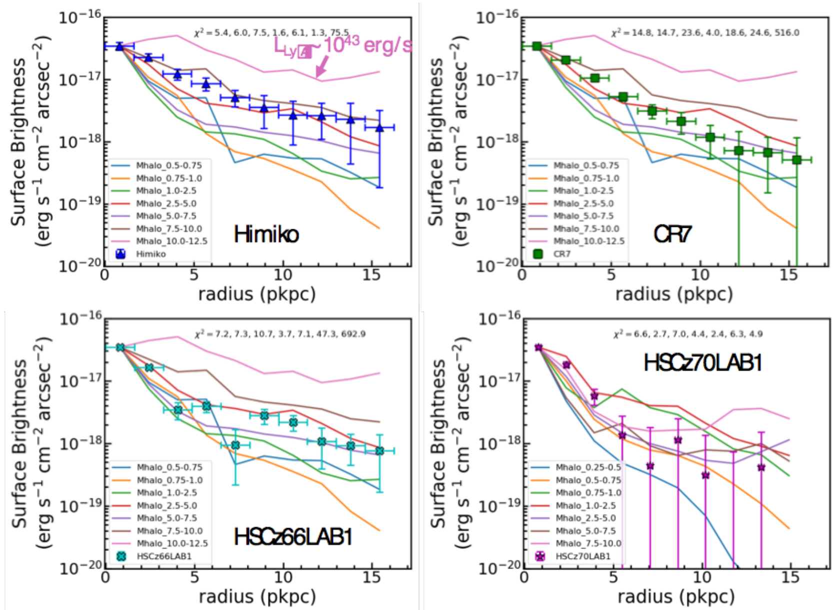

- Resonant scattering: possible, but not enough.
- Cold streams: possible, but not dominant.
- Satellite galaxies: possible, but not dominant.
- Photoionization: possible (Mas-Ribas et al. 2016).

  -> We cannot break the degeneracy with current data.

4. Summary

- We have identified two LABs. The LAB at z=4.9 is possibly an AGN.
- The CGM around LABs does not evolve significantly from z =4.9 to 7.0.
- The physical origin of extended Lyα emission is similar between LABs and normal (non-LAB) LAEs.
- Extended Lyα emission cannot be explained by only resonant scattering. We cannot pinpoint the dominant physical origin with current data.