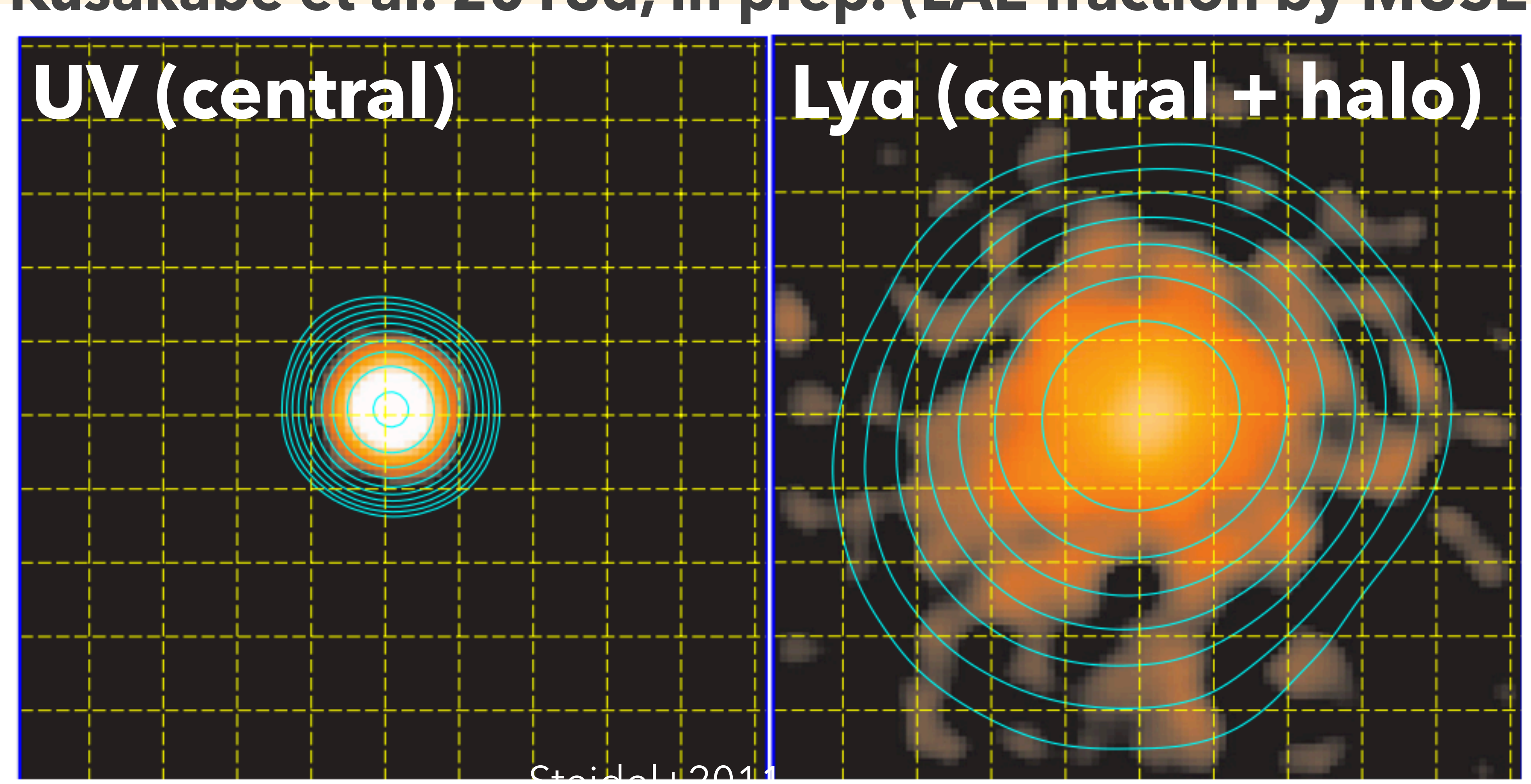
The physical origins of diffuse Lya halos of LAEs at z~2

Kusakabe et al. 2018b, submitted to PASJ, ArXiv:1803.10265
Kusakabe et al. 2018d, in prep. (LAE fraction by MUSE)



8th August 2018, Galaxy-IGM workshop 2018

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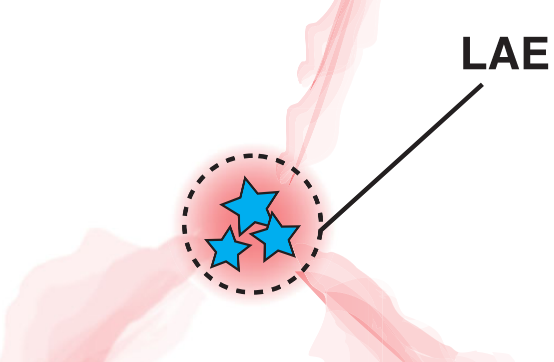
K. Shimasaku, M. Ouchi, K. Nakajima, T. Hashimoto, R. Momose, Y. Harikane, J. Silverman, and P. Capak

Q. The origin of Lya halo (LAH)?

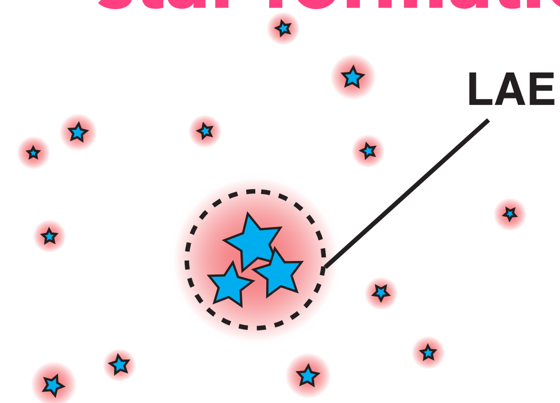
Three candidate origins

(a) cooling radiation from cold streams



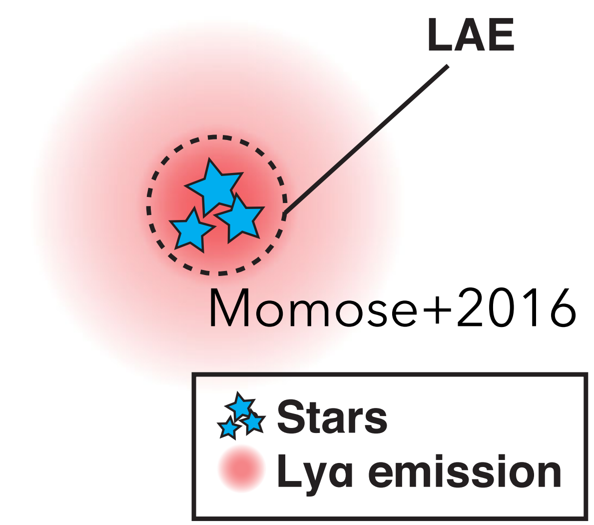
✔? Matsuda+2012(MA12)
large EW
✗? Momose+2016
small EW

(b) satellite star formation



✗? Xue+2017
w/o rs - overdensity
see however MA12
✗? Leclercq+2017
w/o spatial offset

(c) scattered light in the CGM



✔ Lake+15
comparison of
radial profile

(d) fluorescent, (e) shock heating, (f) major merger: perhaps not dominant in SFGs

Neither conclusive nor consistent previous results

Haiman+2000; Taniguchi & Shioya 2000; Cantalupo+2005; Mori & Umemura 2006; Laursen & Sommer-Larsen 2007; Zheng+2011; Rosdahl & Blaizot 2012; Yajima+2013; Lake+2015; Mas-Ribas & Dijkstra 2016

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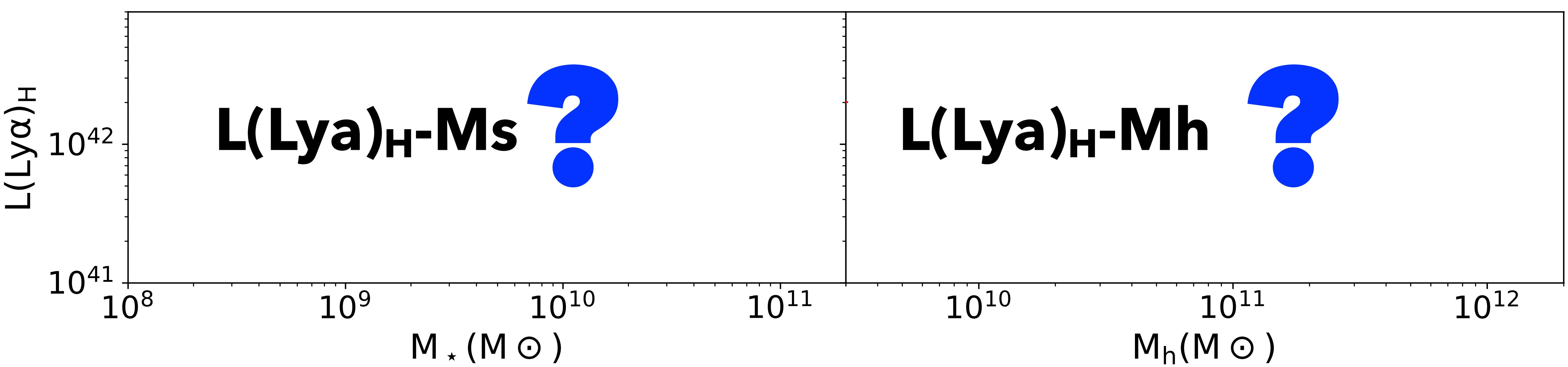

✗? Momose+2016 small EW

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This work

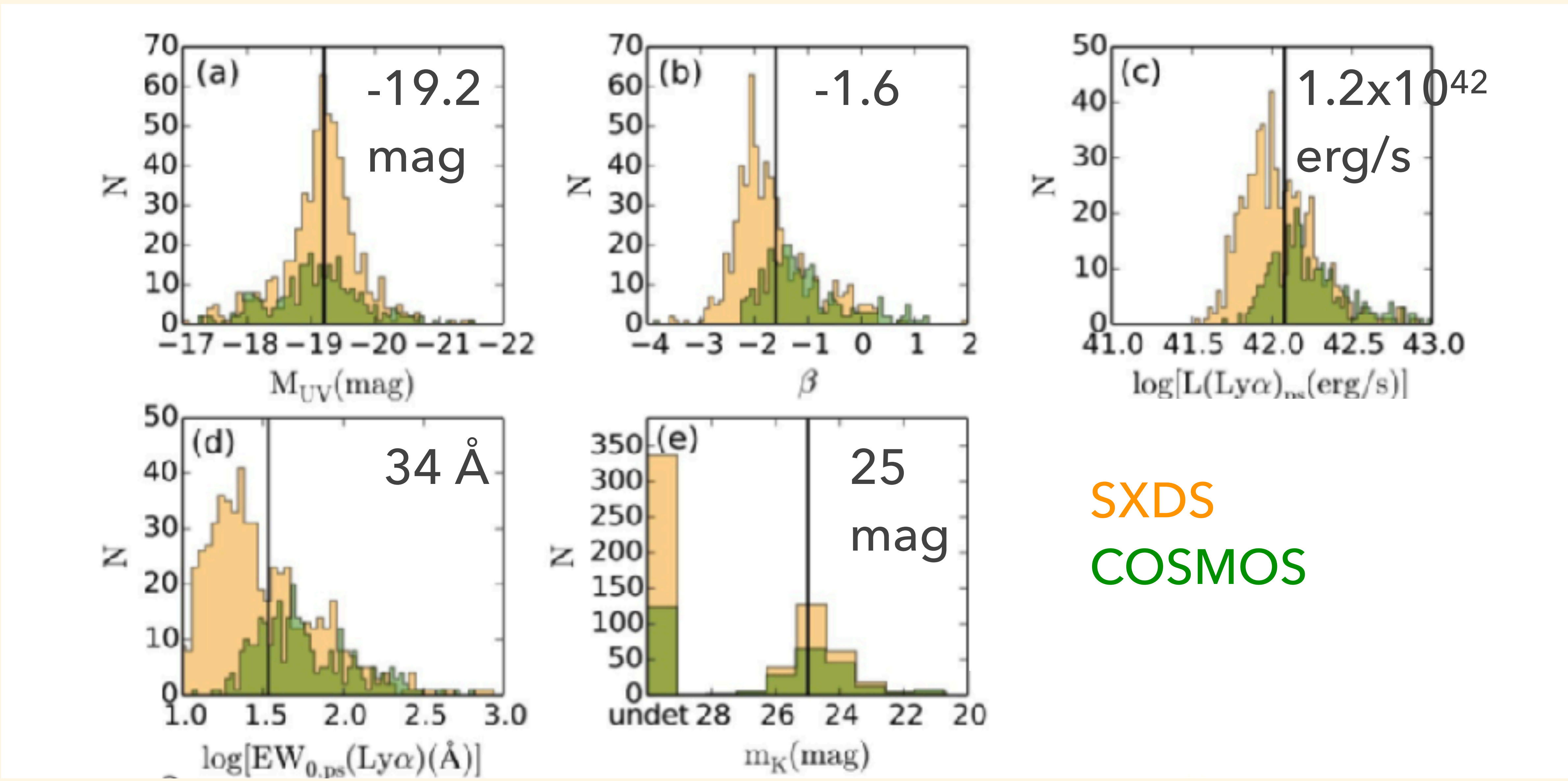
Q. the origin of bright Lya halos of LAEs?

$L(Lya)_H$-Ms, and $L(Lya)_H$-Mh

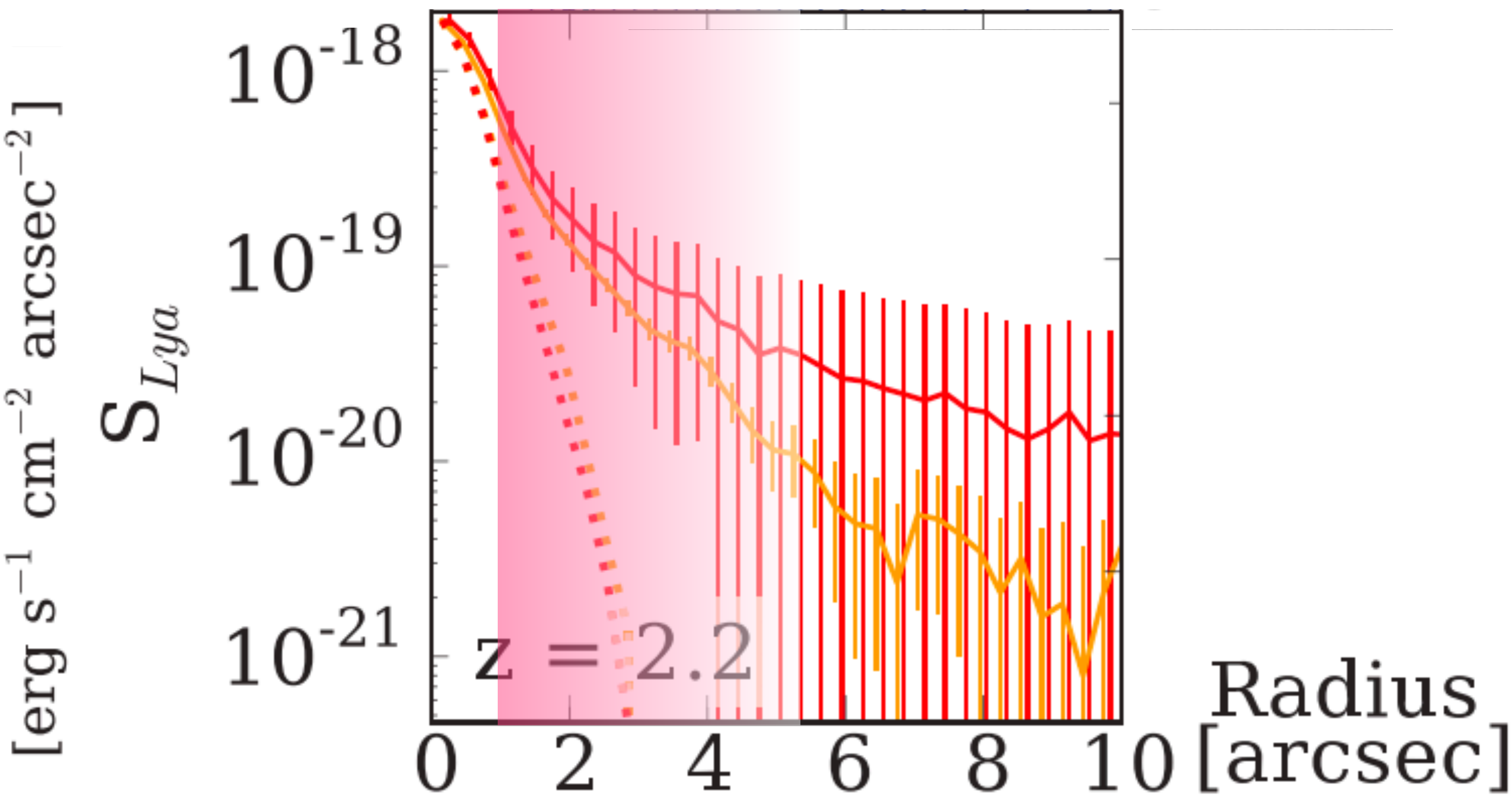
Field	NB mag lim(5σ)	Area (min²)	NBtot<=25.5 (sed)
SXDS	25.7	~1240	**601(93)**
COSMOS	26.1	~740	**297(47)**
TOTAL		**~2000**	**~900**

- **divided into subsamples** (Nakajima+2012, +2013; Konno+2016; HK2018a)
- **LAH luminosity: stacked relation**
- **Mh: clustering analysis**
- **Ms, and SFR: stacked SED fitting (UV-optical)**

subsample selection:
M(UV), β, L(Lyα), EW(Lyα), m(K)



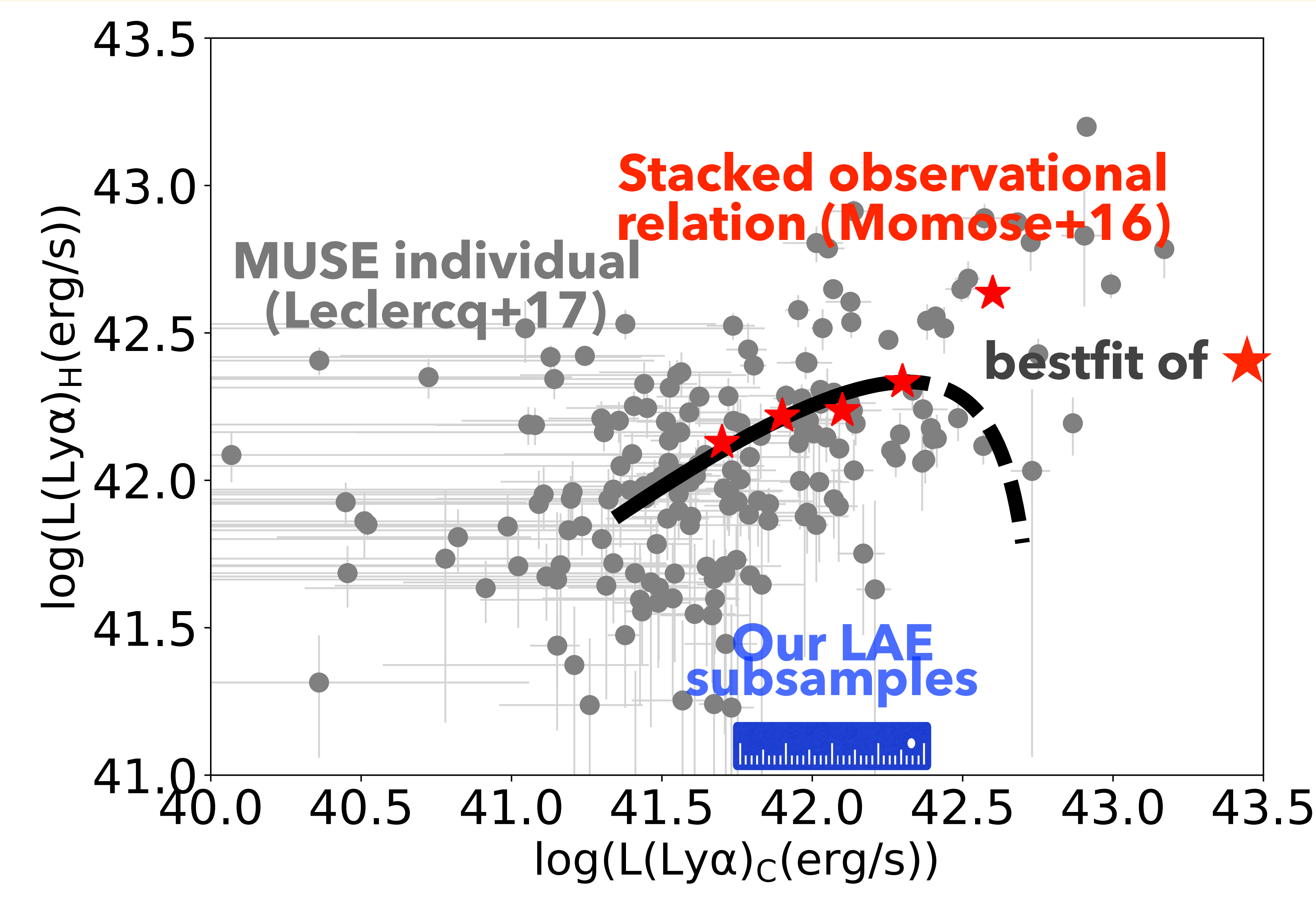
Estimating L(Lyα)$_H$ from L(Lyα)$_C$



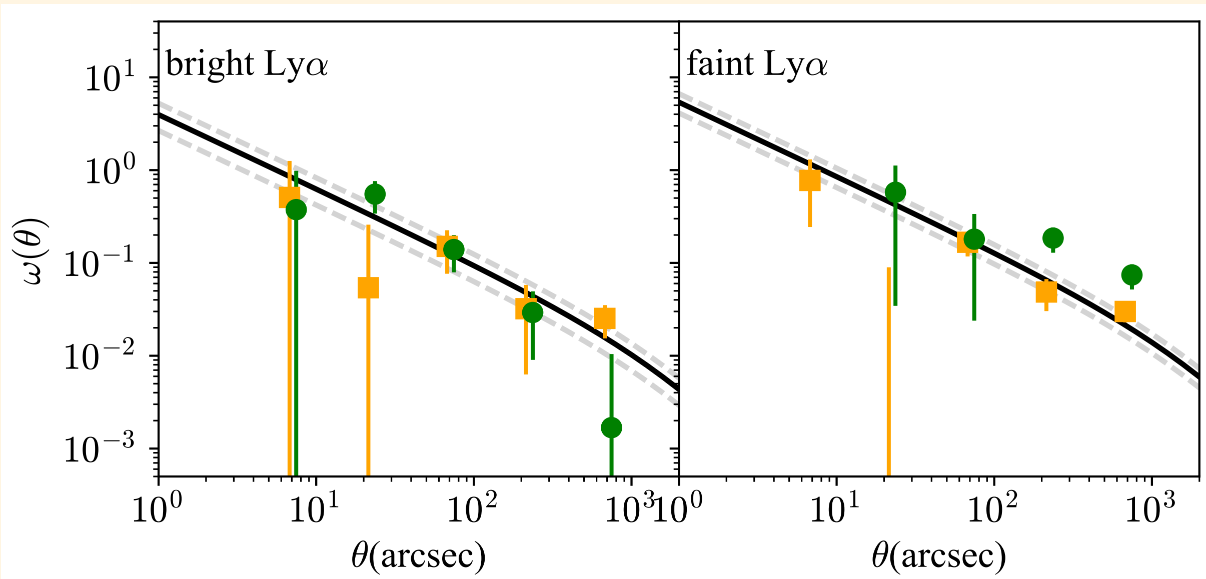
L(Lyα)$_C$	L(Lyα)$_H$
r<1″	r ~1″- 5″
(~8kpc)	(~8-40 kpc)

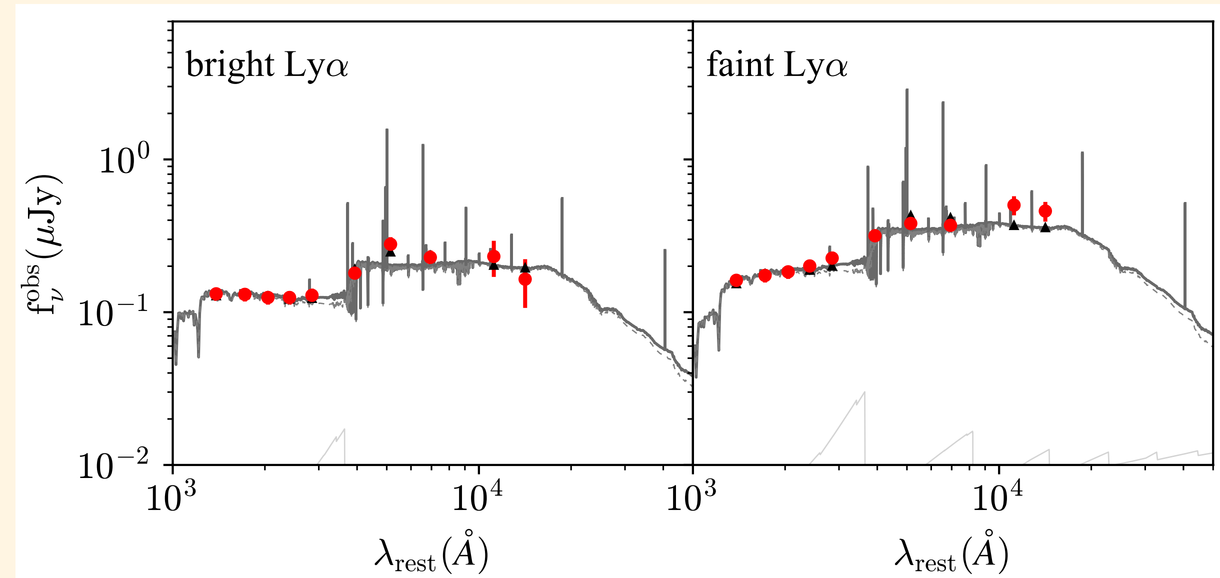
Momose+2014

Estimating $L(Ly\alpha)_H$ from $L(Ly\alpha)_C$



Clustering analysis & SED fitting





derived parameters: Mh

ACF: Landy & Szalay 1993
γ=1.8: Ouchi+2010
ro-Mh: Tinker+2010; Eisenstein & Hu 1998, 1999
fitting range=40-1000", Contami fraction=0-20%
: HK+2018a;

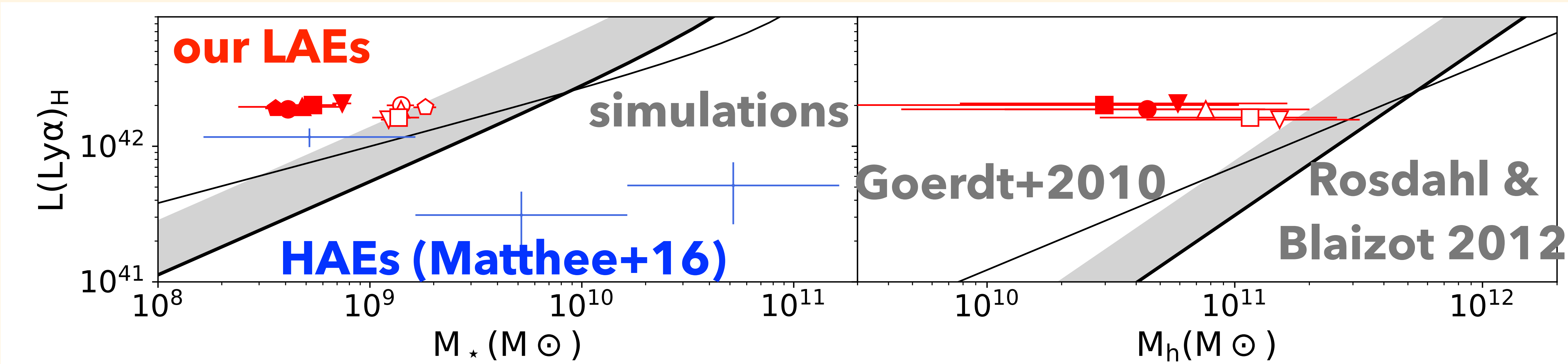
SFR, $M_\bigstar$, age, E(B-V)

B, V, R, I, z, J, H, K, IRAC ch1 & ch2
SSP: Bruzual & Charlot 2003
nebula: Ono+2010
$E(B-V)_\bigstar$ = E(B-V)g: Erb+2006
SMC-like curve: Gordon+2003; HK+2015
fesc(ion)=0.2: Nester+2013

with the same methods as in HK+2018a

(HK+18a, b)

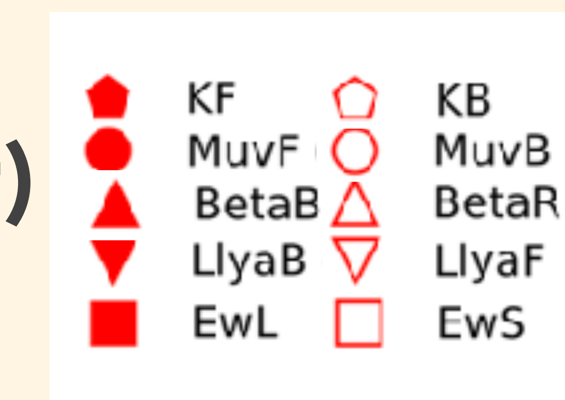
(a) Cold streams (cooling radiation)



LAEs: nearly flat slope & high $L(Ly\alpha)_H$

Simulations: steeper slope ($\propto Mh^{0.8\text{-}1.3}$, $>2\sigma$)

lower $L(Ly\alpha)_H$ for low-$M_\star$ objects (>10σ)



→ not the dominant origin of LAHs

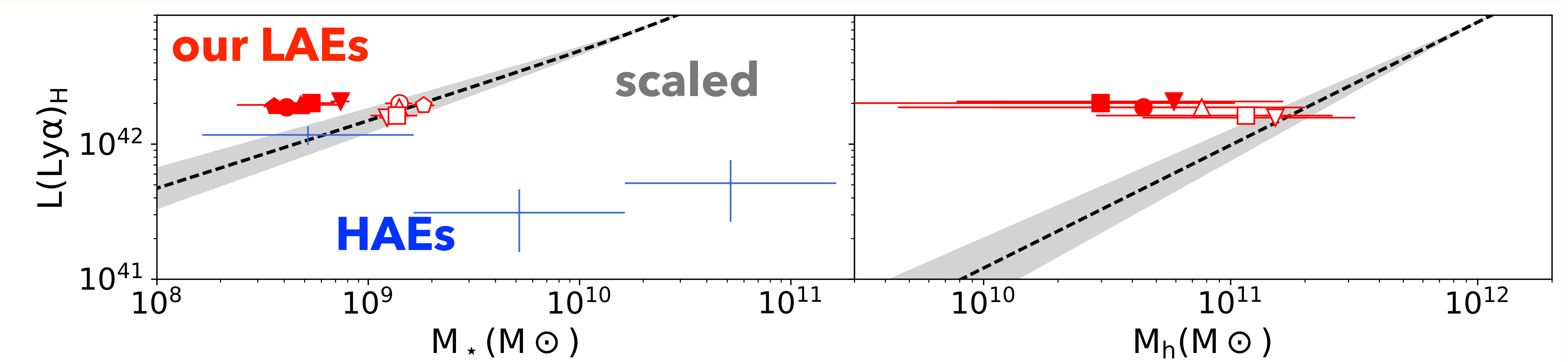
HAEs: nearly flat slope

Note: Redshift correction of $L(Ly\alpha)_H \propto (1+z)^{1.3}$ applied in Goerdt+2010

Mh→Ms with SHMR at z~2 in Moster+2013

(HK+18b)

(b) Satellite star formation



LAEs: nearly flat slope

Obs. & Simu. : the number of satellites increases w/ the Mh ($\propto Mh^{0.91\pm0.11}$) and $M_\star$

→ not the dominant origin of LAHs

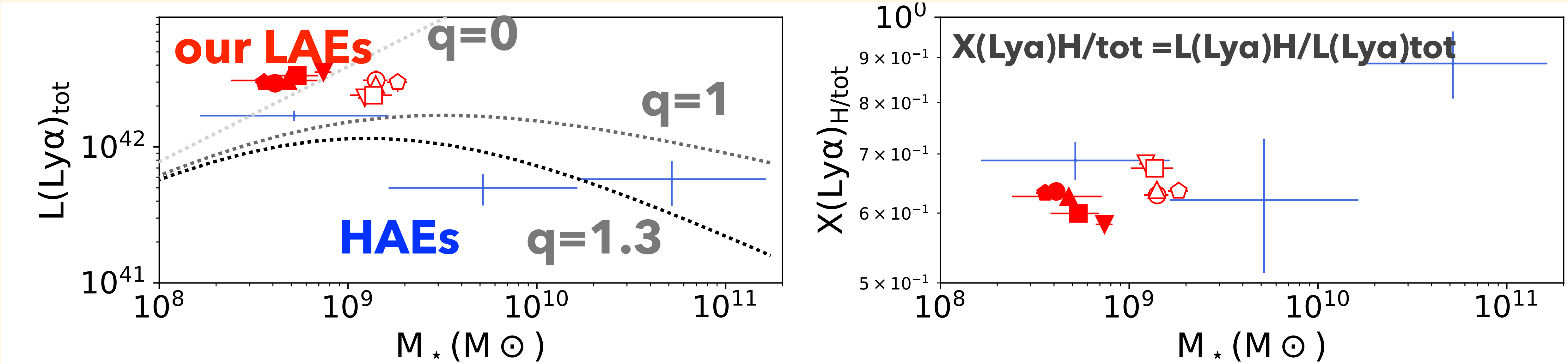
HAEs: nearly flat slope

Note: arbitrary normalization

(HK+18b)

Trenthman & Tully 2009; Wang+2014; Tal+2013; Okamoto+2010; Moster+2013; Matthee+2016

(c) Scattered light in the CGM



Model: L(Lya) H = L(Lya) tot * X(Lya)H/tot

L(Lya)tot = L(Lya)$_{SFR(M_\star)}$*10^(-A$_{1216Åcon}$($M_\star$)*q)

q=A$_{Lya}$/A$_{1216Åcon}$($M_\star$)

LAEs: can be explained by varying q and X

→ the dominant origin of LAHs

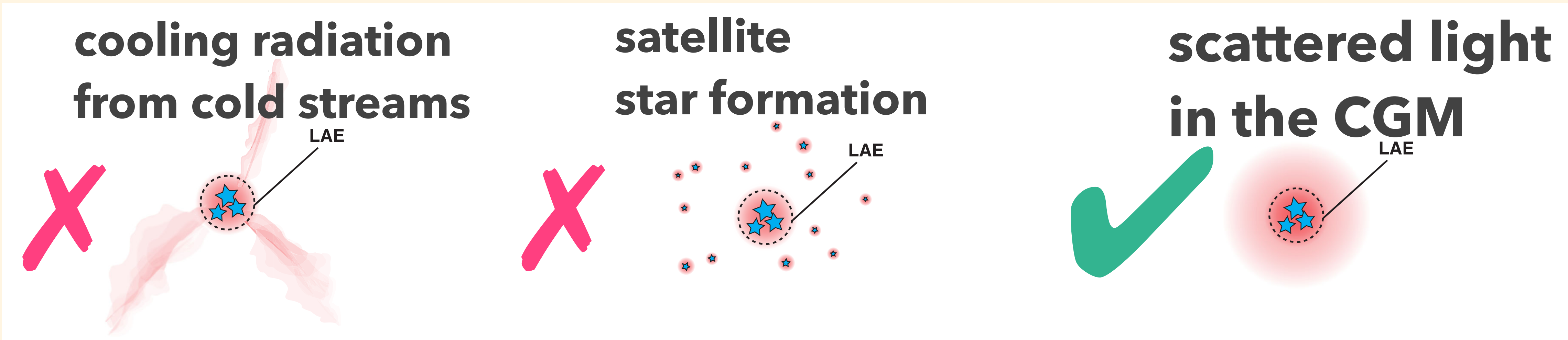
HAEs: can be explained by varying q and X

Shivaei+2017; Heinis+2014; Matthee+2016

(HK+18b)

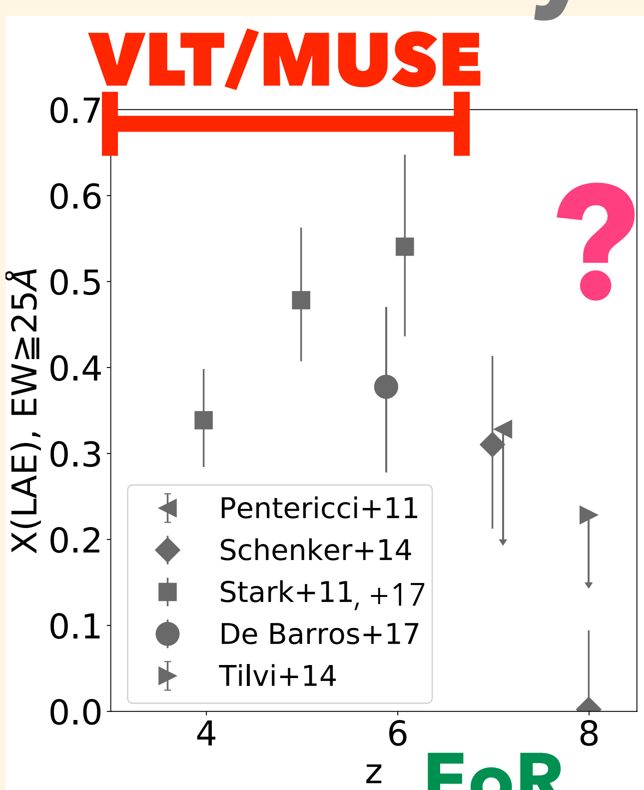
Take home messages

Q. the origin of bright Lya emission of Lya halo?



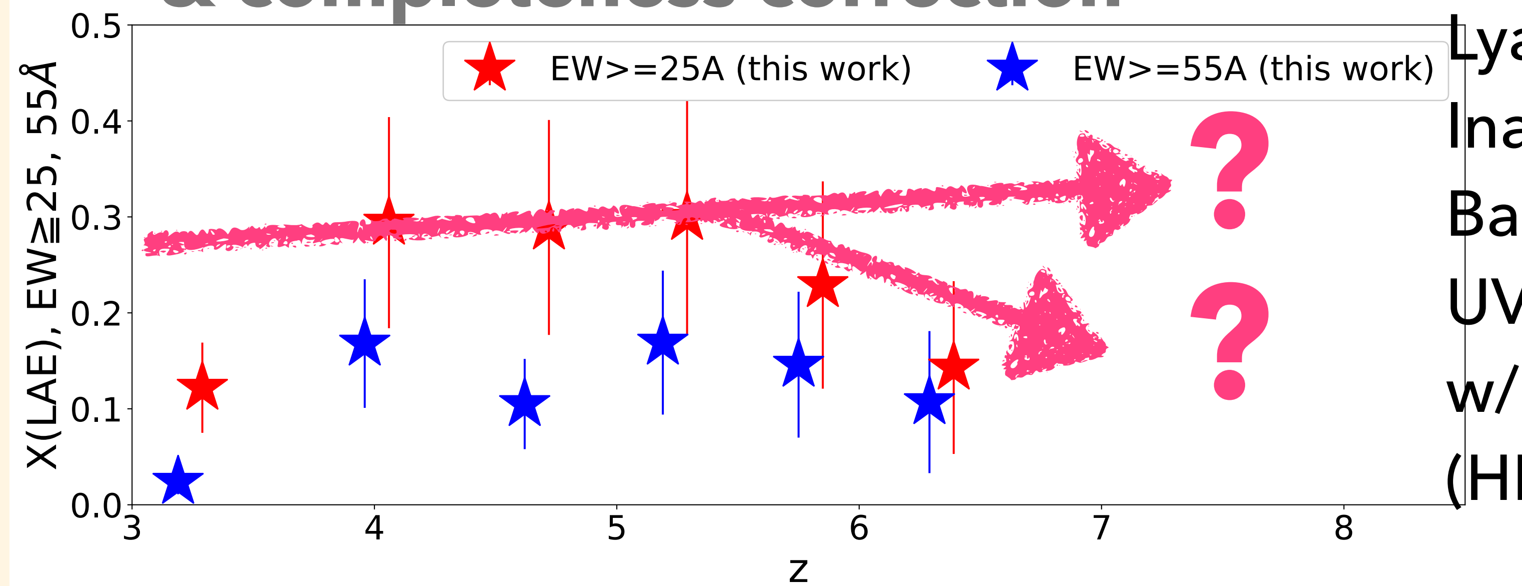
HSC enables us to obtain their Mh more accurately!

Preliminary: Lya fraction by MUSE



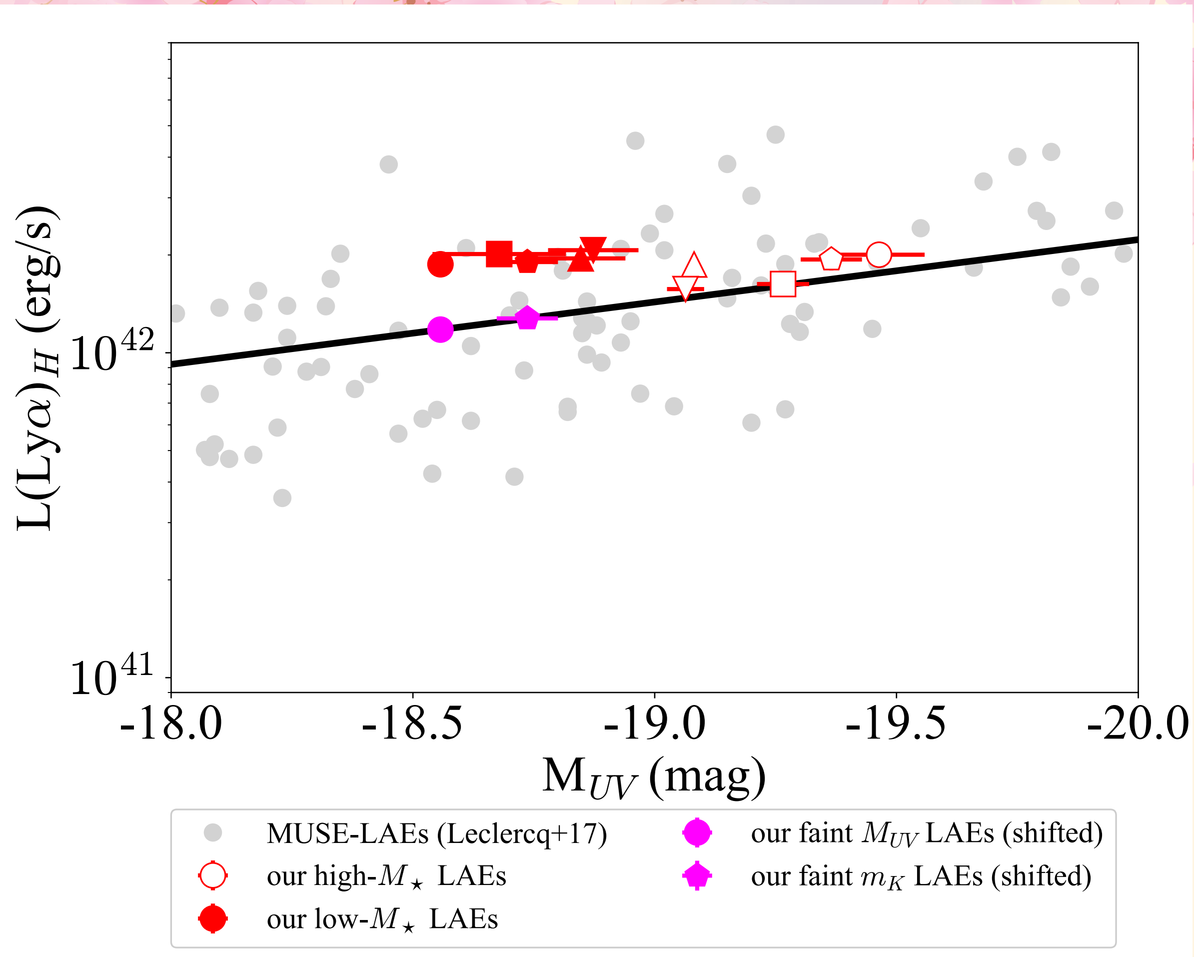
working on new reduced data (DR2)

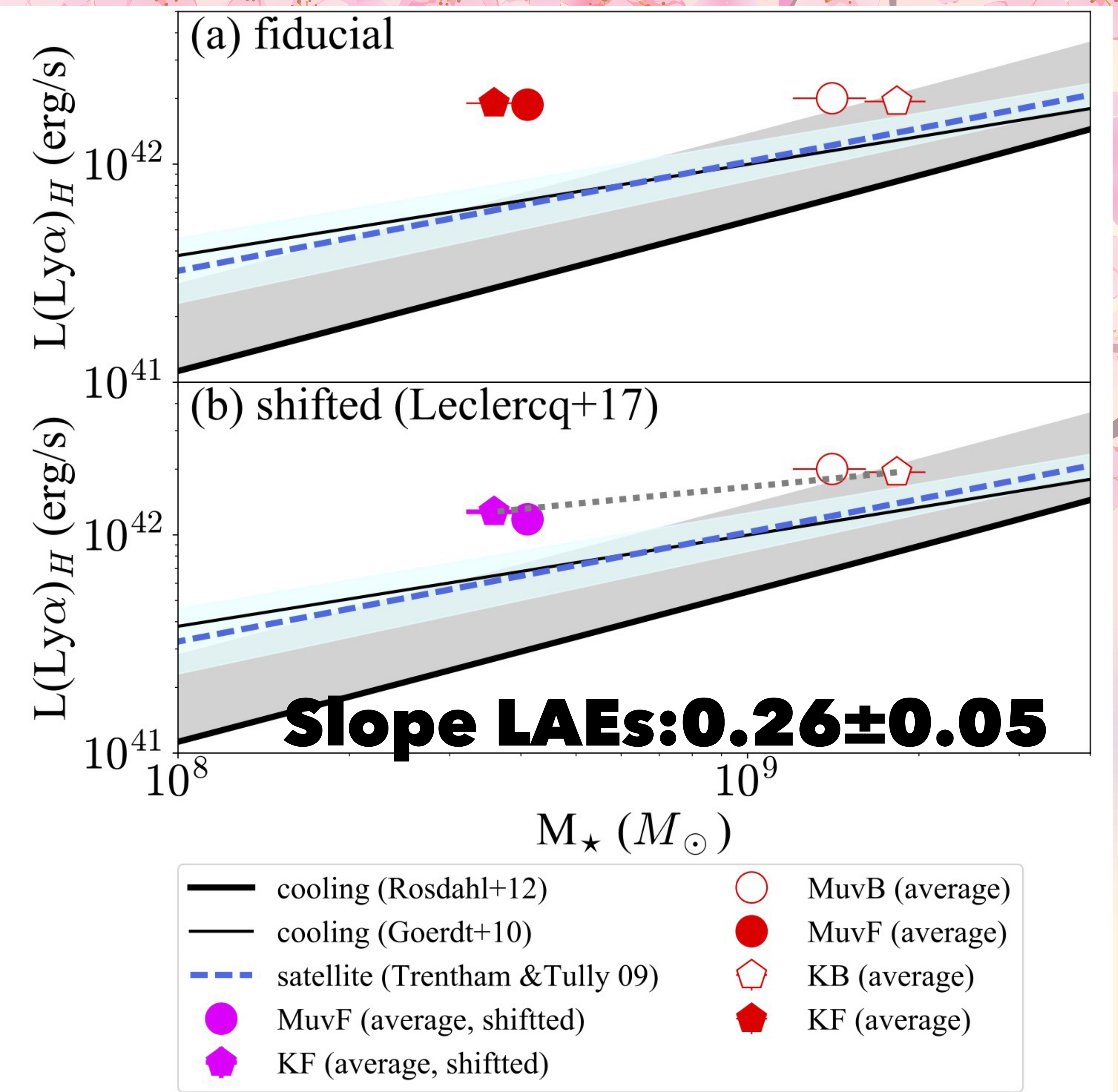
& completeness correction



Lya MUSE DR1:
Inami+17;
Bacon+17,
UV: Rafelski+15
w/o comp. corr.
(HK+18d in prep.)

Appendix





Cold stream:~0.38, 0.75,

Satellite SF:~0.40±0.13