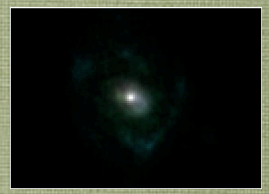
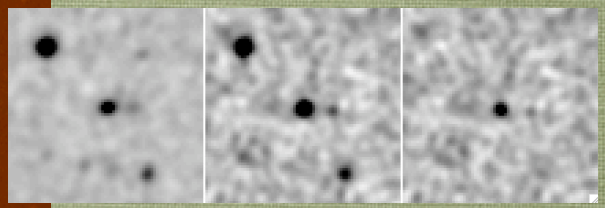
The Nature and Clustering of Star-forming galaxies at z=0.84



David Sobral



Sobral et al. 2009a - arXiv:0901.4114 MNRAS - in press

Sobral et al. 2009c,d, in prep.

Collaborators: P. Best, J. Geach, I. Smail, M. Cirasuolo, J. Kurk, M. Casali, R. Ivison, K. Coppin, G. Dalton

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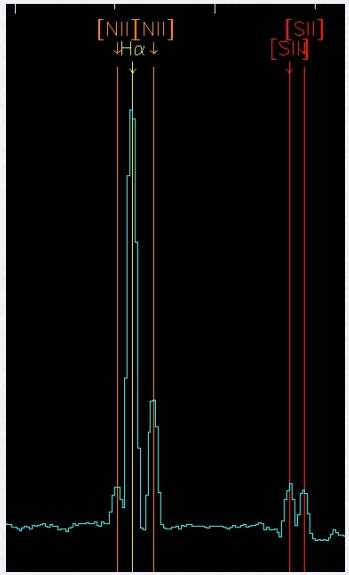
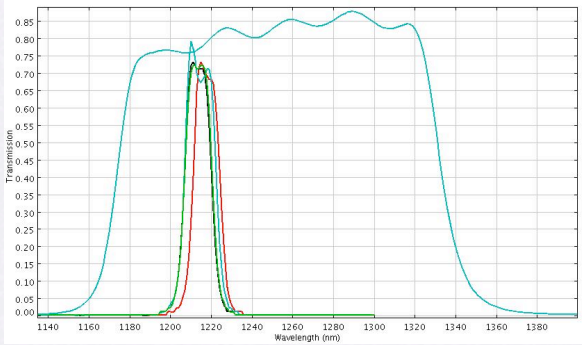
HiZELS

- **High-Redshift(Z) Emission Line Survey**
- Selecting Star-forming galaxies: **z ~0.8 to 9**

Sobral et al. 2009b (in prep.)

- Hα at z= **0.84,** 1.48**,** 2.23 (Geach et al. 08**, Sobral et al. 09**)
- **NBJ**: [OIII] at z=1.44, [OII] at z=2.23, **Lyα at z=8.9**
- **~5 sq.deg**, **>1000 SF** galaxies in **each band (+AGN)**
- **Campaign Program** at **UKIRT**





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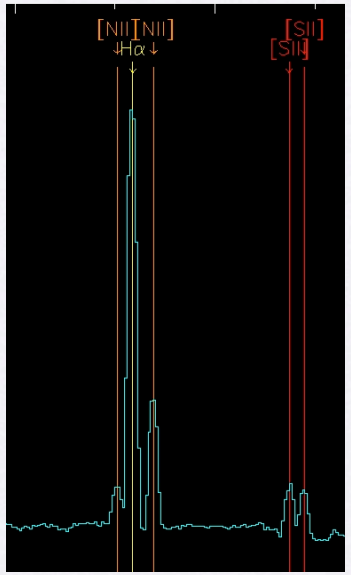
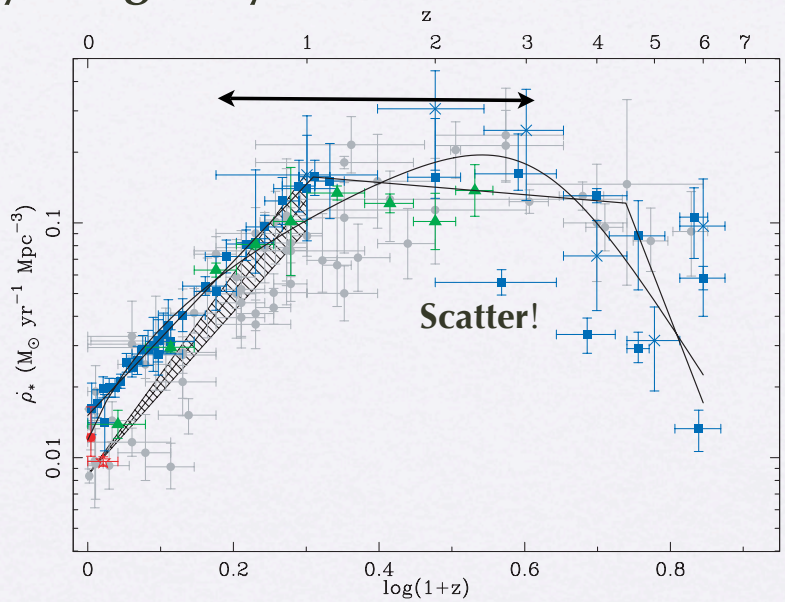
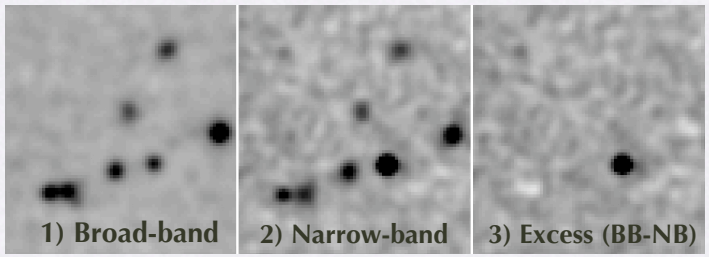


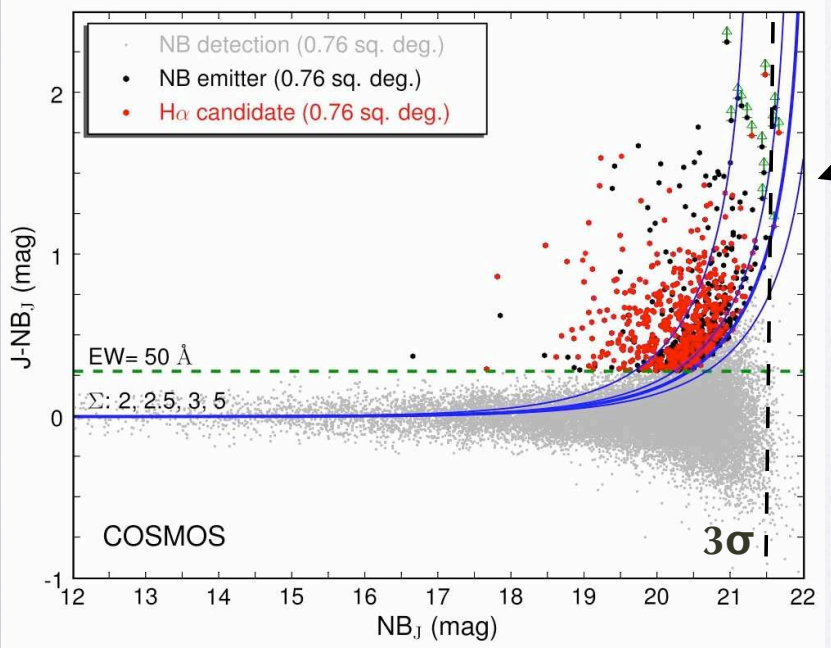
Deepest+widest survey combination: 10^{-16} erg $s^{-1}cm^{-2}$
~ 1.5 sq. deg. over COSMOS and **UKIDSS UDS**

Why bother?

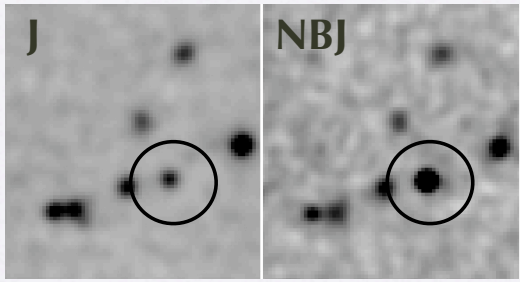
- **<u>Star-formation rate density: key for galaxy formation and evolution</u>**
- Different SFR tracers
- Environment/clustering signal
- Key epoch: **1<z<3**
- **H-α: sensitive, well-calibrated**
- Now **WF-NIR -** on **large areas**
- Can be used **up to z~2.5**





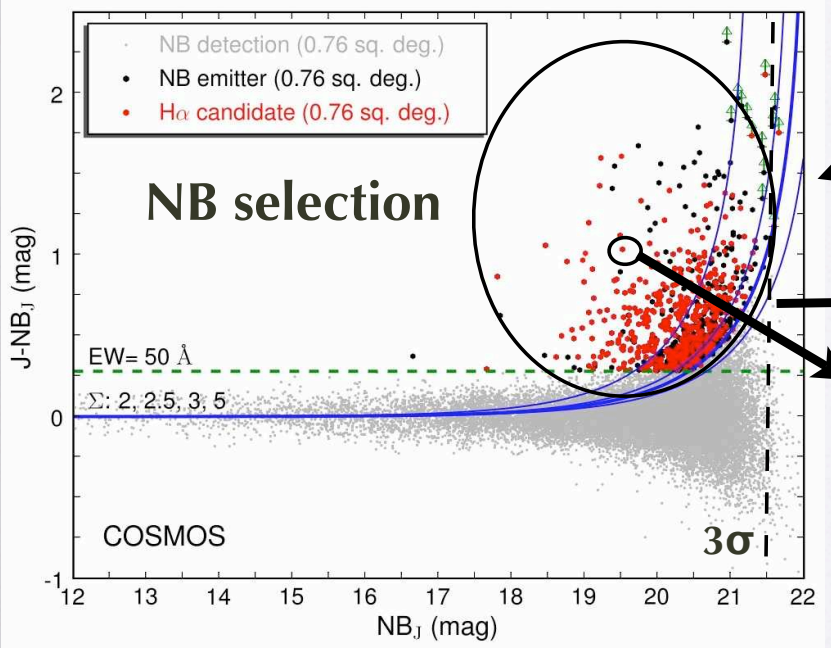


Optimized Source extraction (SExtractor)



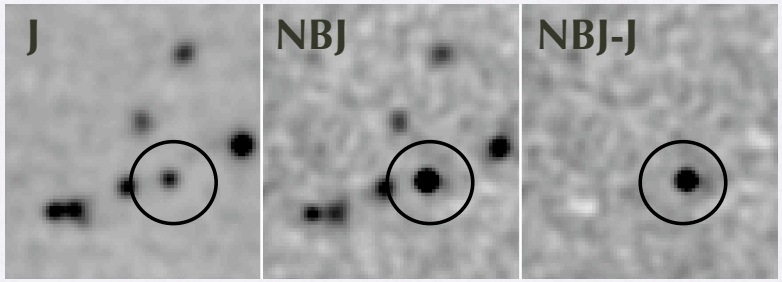
Getting the sample of Hα emitters at z=0.84

Sobral et al. 2009 (arXiv:0901.4114)



Optimized Source extraction (SExtractor)

~1500/1300 line emitters



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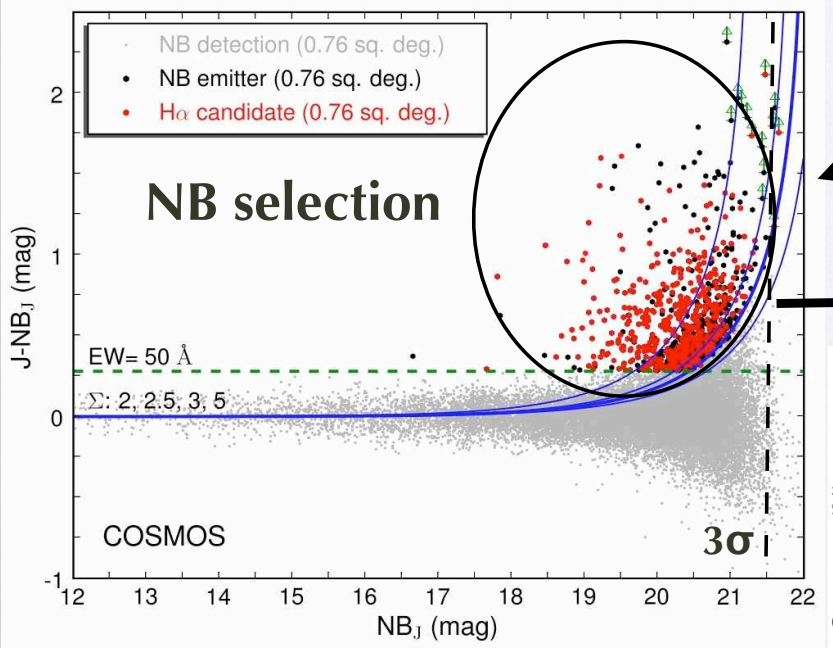

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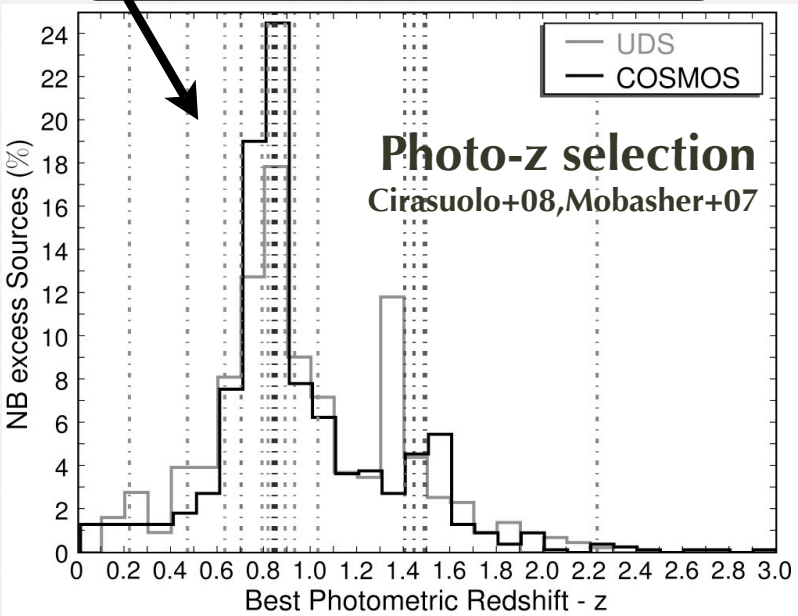

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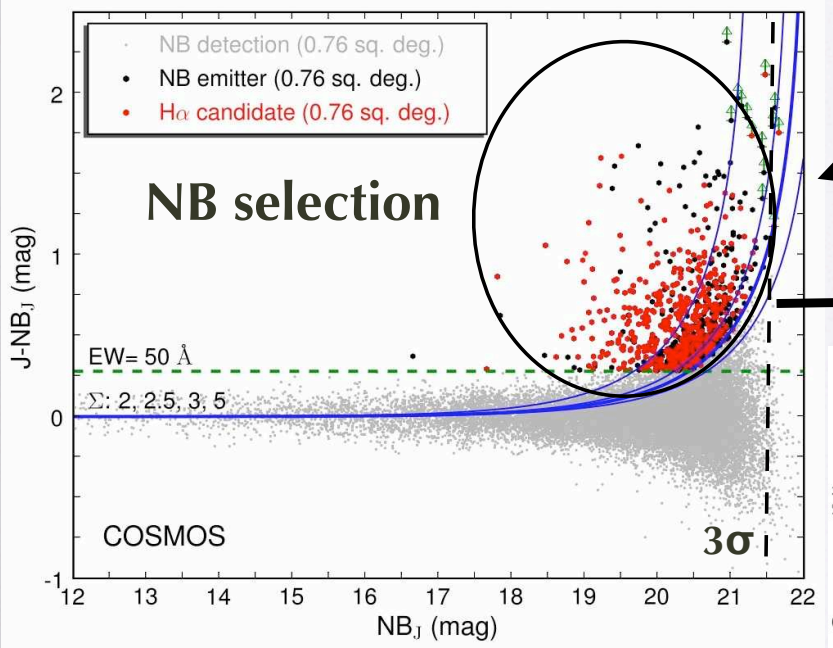

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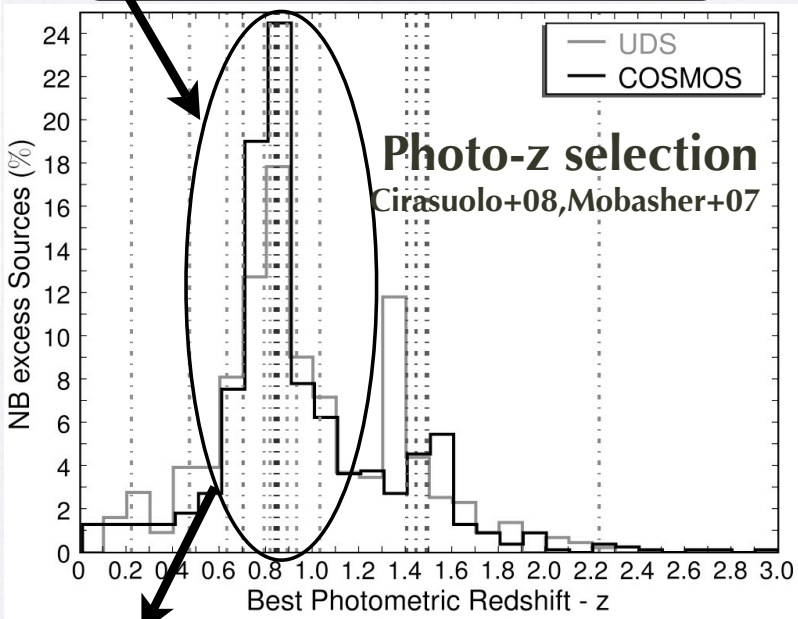
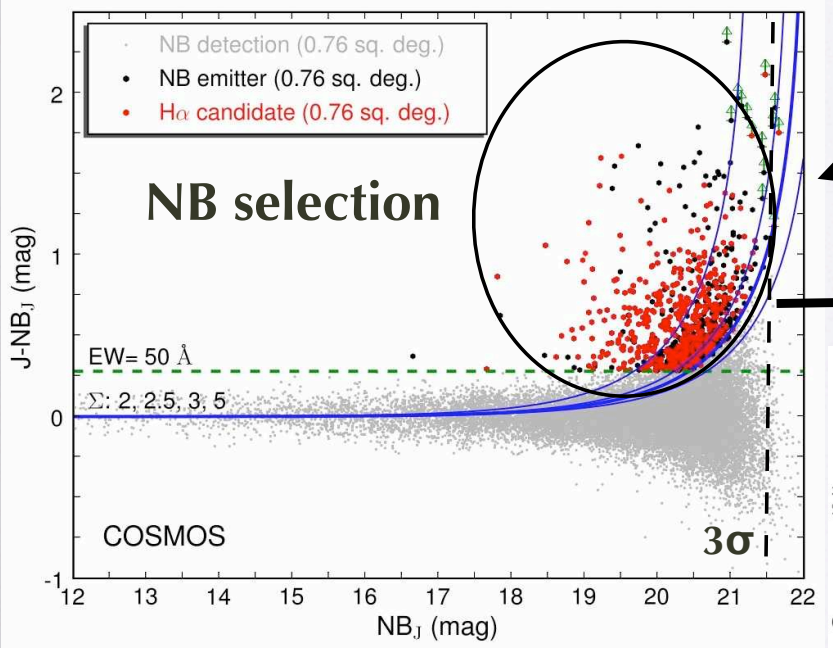


Result: ~750 Hα emitters

Sobral et al. 2009 (arXiv:0901.4114)



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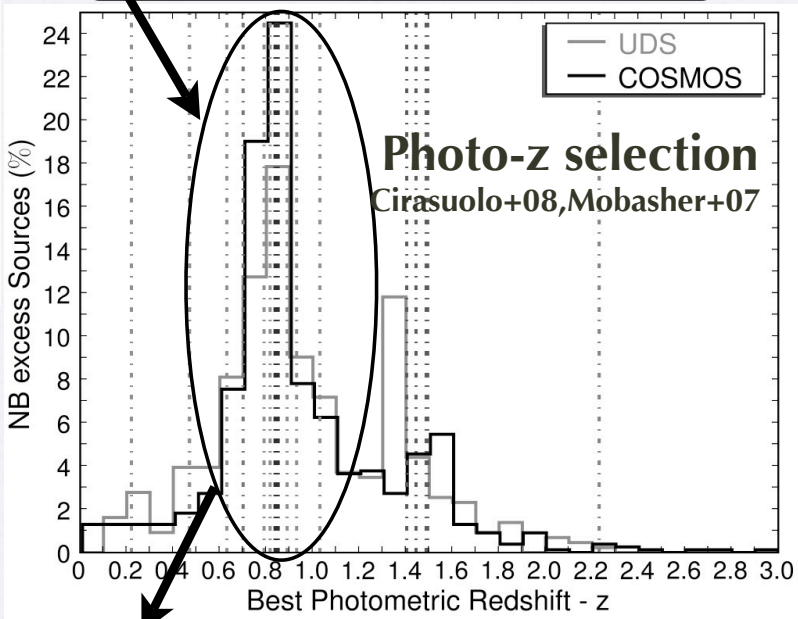

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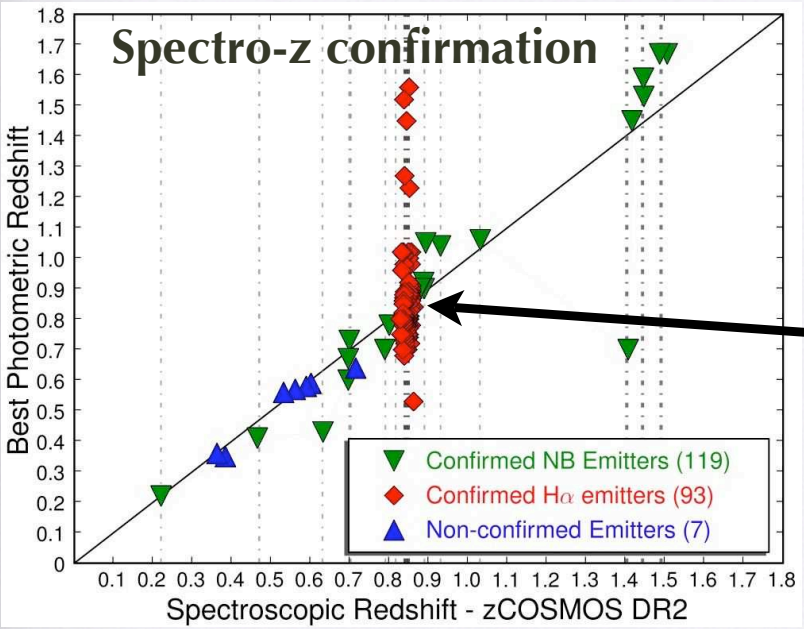

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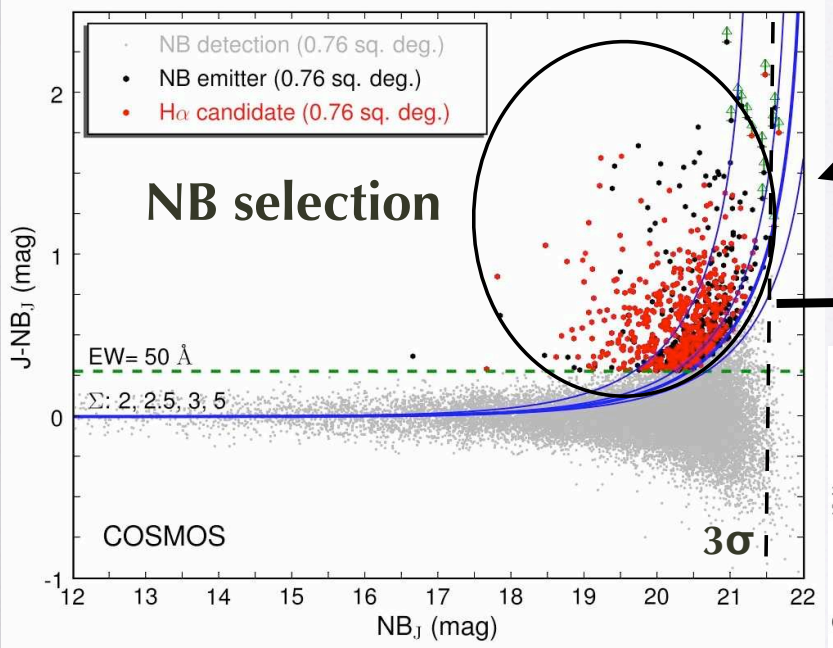

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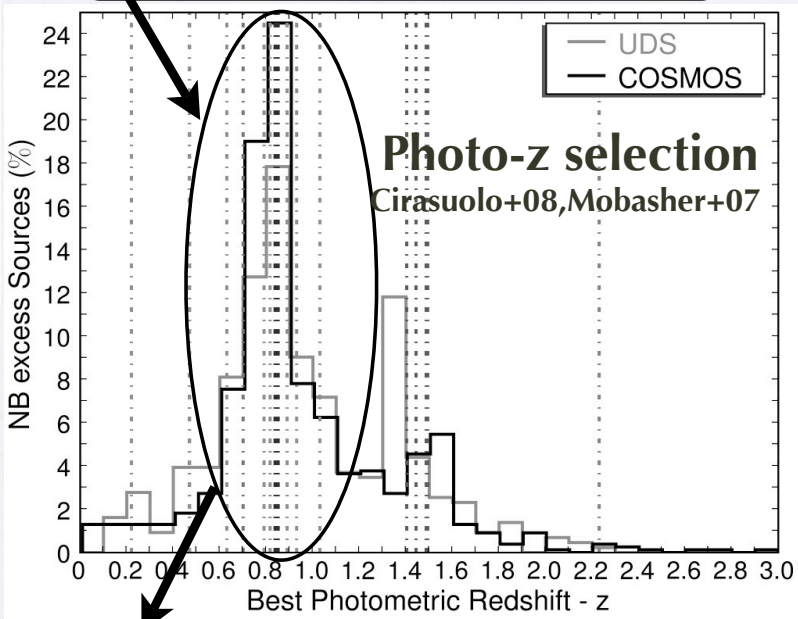

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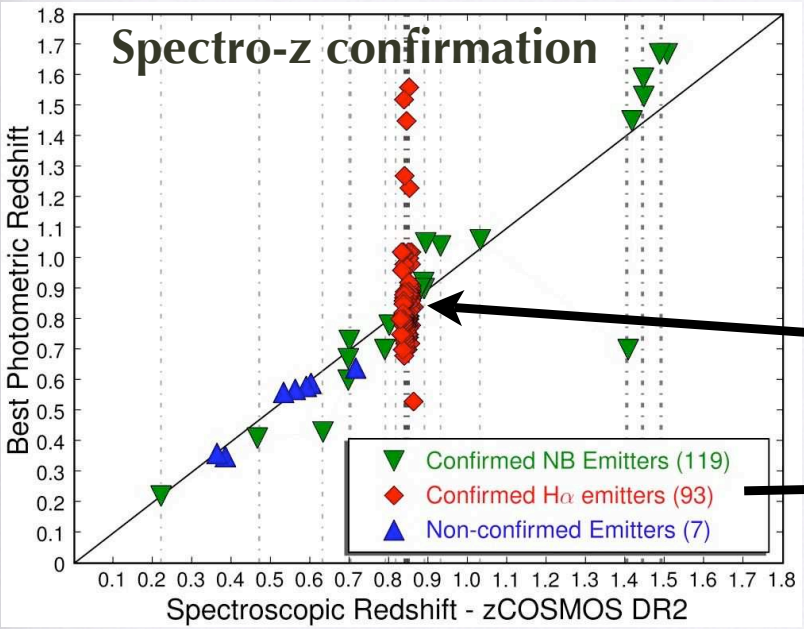
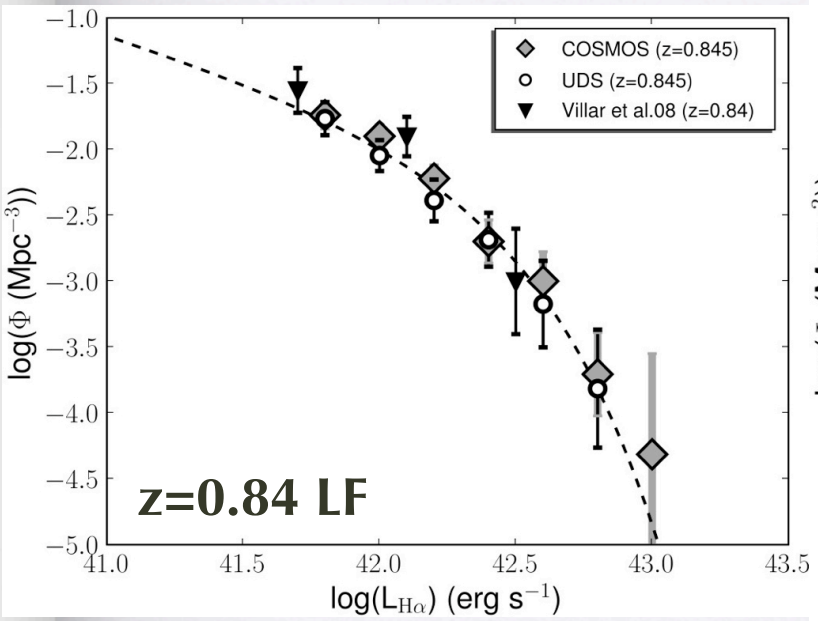


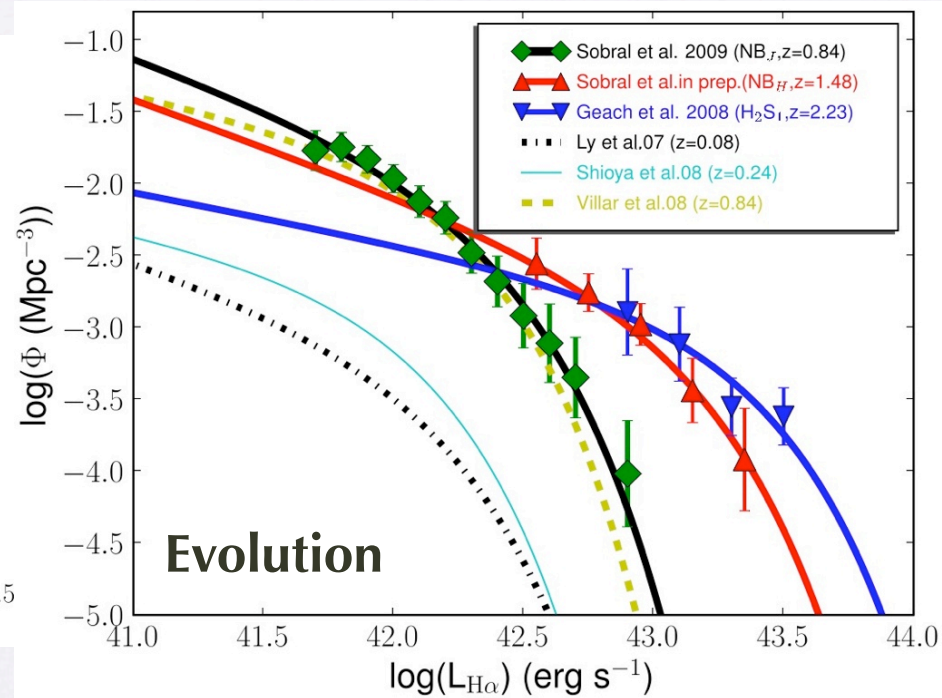
Sample 95% reliable
96% complete

Sobral et al. 2009 (arXiv:0901.4114)

Hα Luminosity Function

Sobral et al. 2009a&d

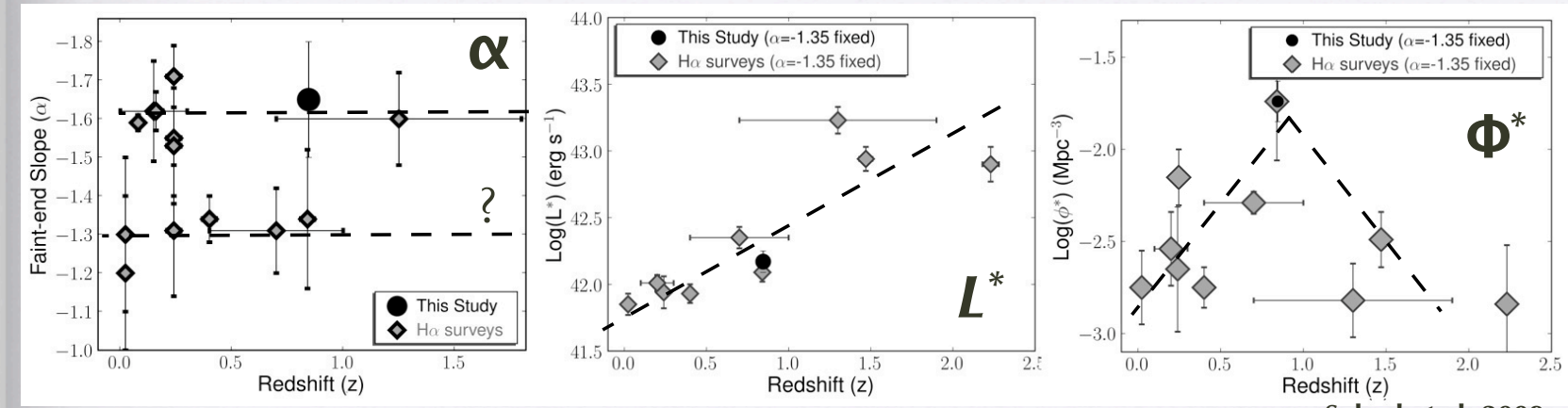




- Corrections: Extinction (1 mag), completeness, [NII] contamination, Filter biases
- COSMOS and UKIDSS UDS LFs agree quite well.
- Luminosity function evolution determined up to z~2.3

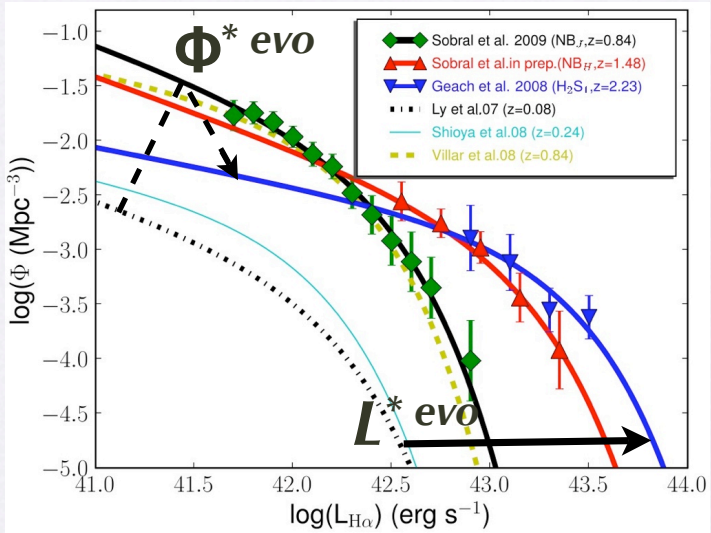
Schechter function parameters: Hα LF evolution

$$\phi(L)dL = \phi^*(L/L^*)^\alpha \exp(-L/L^*)d(L/L^*)$$



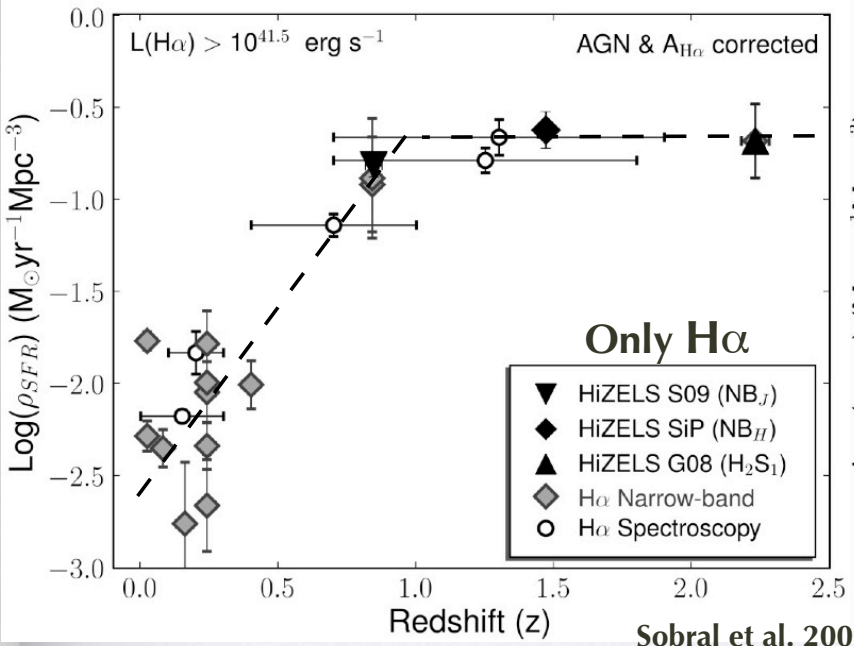
Sobral et al. 2009a

- Clear evolution in the Hα LF:
- ***L*** **rising*** at least **up to z~2.3**
- **Φ* rising up to z~1** and **falling after**
- Faint-end slope? (bias,cosmic variance?)

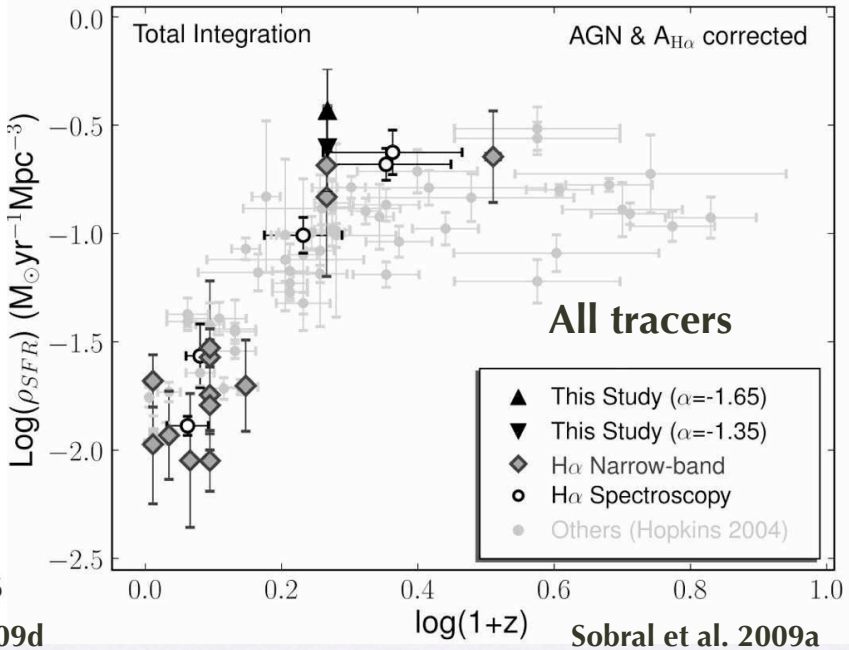


The Evolution of the Star-formation Rate Density

- 15% AGN correction



Sobral et al. 2009d



Sobral et al. 2009a

- $\rho_{SFR41.5}$= 0.15±0.01 $M_o yr^{-1} Mpc^{-3}$ / $\rho_{SFRtotal}$= 0.37±18 $M_o yr^{-1} Mpc^{-3}$
- Steady **rise up to z~1**; **flattening** afterwards
- **Strong evolution** determined with **one single SFR indicator**
- **Faint-end slope crucial** for total integration

z=0.84 Hα emitters - HST+SUBARU(*Brz*)

ZEST class
Scarlata et al. 2007
+
Visual

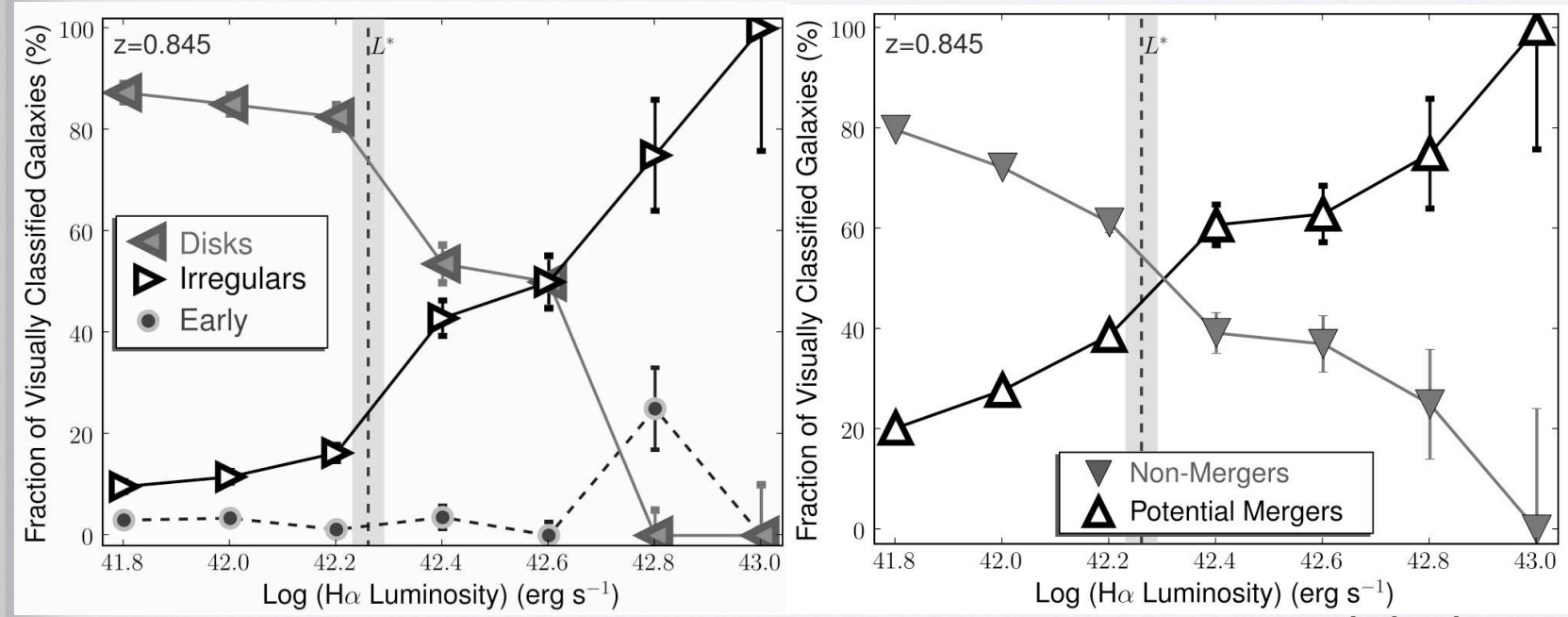
→

Disks	83%
Irregulars	15%
Ellipicals	2%

with:

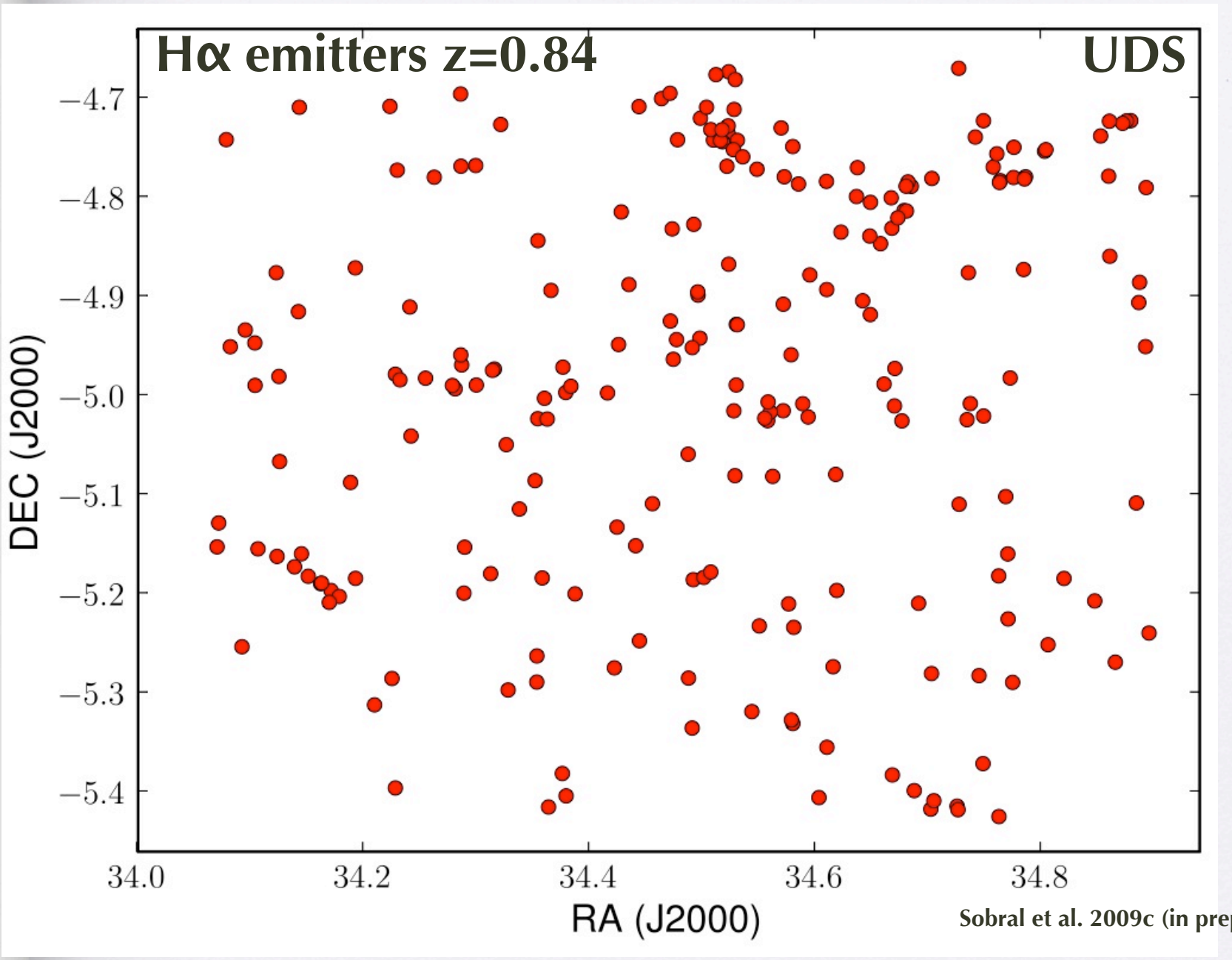
Non-mergers	70%
Mergers	30%

Morphology-Hα

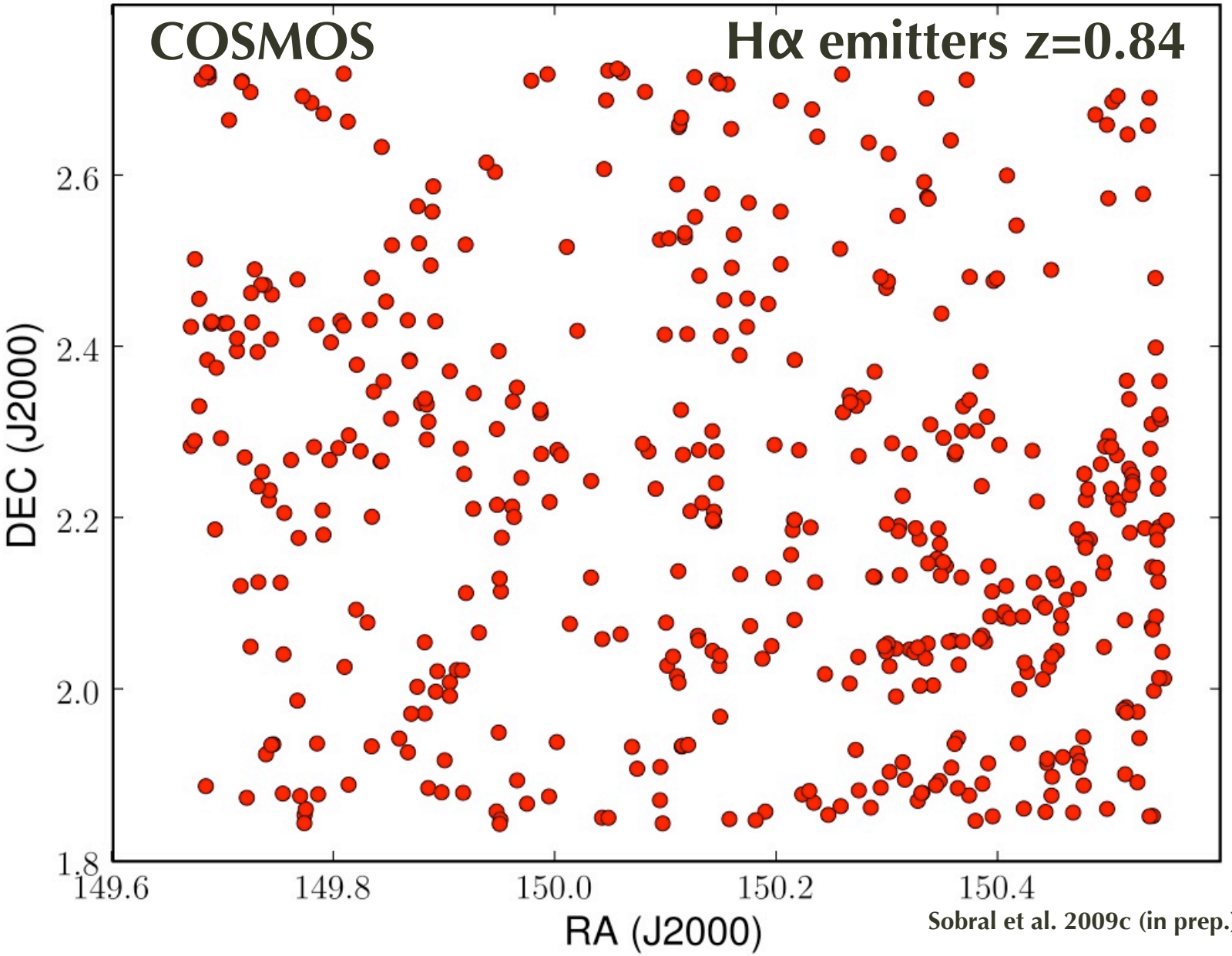


Sobral et al. 2009a

- Disks/non-mergers completely dominate at ***L<L****
- Clear Population "shift"**~*L****: **Irr/mergers dominant** (reaching 100%)
- **Irr/mergers dominate high SFRs** but account for **~20%** **<u>total</u>** ρ_{SFR}
- Disks/non-mergers drive the strong decrease in ρ_{SFR} at z<1



Sobral et al. 2009c (in prep.)

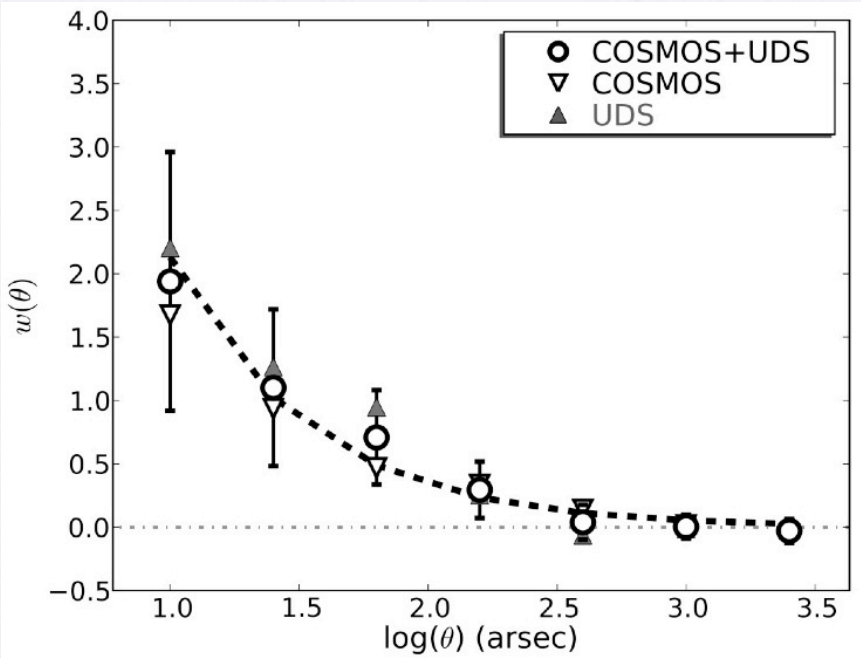


Sobral et al. 2009c (in prep.)

Clustering Properties

- Visually clustered & related to underlying population
- 2-point angular correlation function $\omega(\theta)$ **Landy & Szalay (1993)**
- 2 fields agreeing well (but UDS slightly higher)

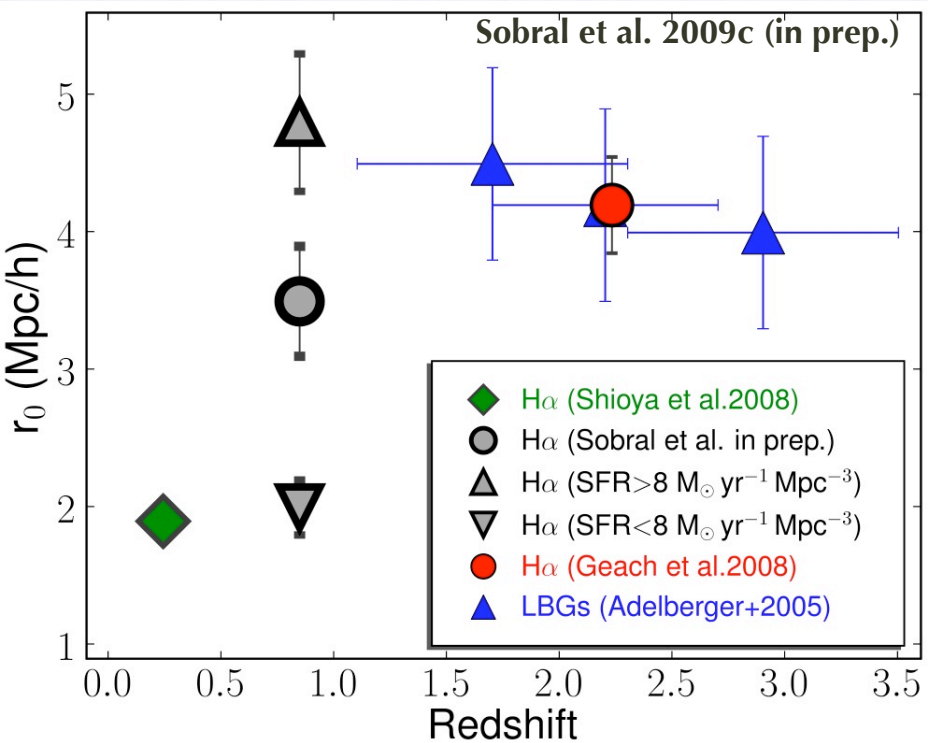
- $\omega(\theta)=(13.4\pm4.3)\ \theta^{0.8\pm0.1}$
- COSMOS: $\mathbf{r_0}$=3.2±0.4 Mpc/h
- UDS: $\mathbf{r_0}$=4.2±0.7 Mpc/h



Sobral et al. 2009c (in prep.)

Clustering Evolution

- Real-space length ($\mathbf{r_0}$)= 3.5±0.4 Mpc/h
- **Clustering strength depends on SFR/ luminosity**
- $\mathbf{r_0}$ higher for the more luminous emitters and for Irregulars



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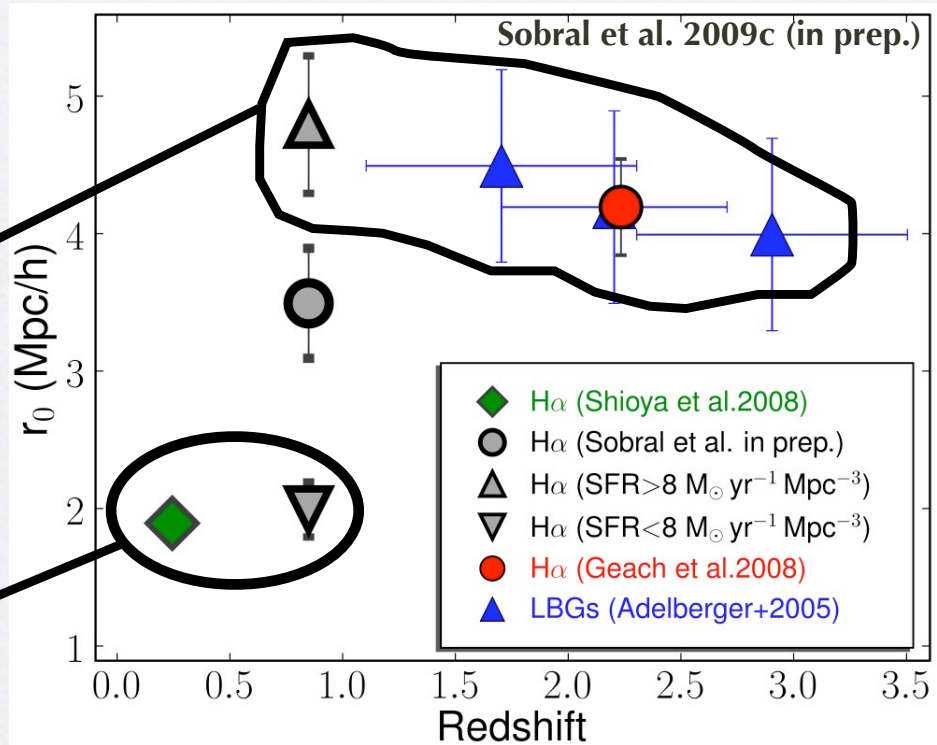
Samples presenting high SFRs

Samples presenting low SFRs



Conclusions

- Deepest+wider survey ~**750 SFG at z=0.84**
- ***L** rises** up to z~2, **Φ* rises** up to z~1 and falls
- ρ_{SFR} measured with **one SFR tracer z<2.3**
- **Mostly disks** (80%) and non-mergers (70%)
- **But... Irregulars/Mergers dominant at *L*>*L****
- **Mergers ~20% of total** ρ_{SFR} at z=0.84
- **Disks responsible for decline in** ρ_{SFR}
- **Significantly clustered; *L* dependence**

Thank you.

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Sobral et al. 2009 - astro-ph/0901.4114 MNRAS - in press