Faint Lyman Alpha Emmitters and Lyman Break Galaxies in the A2744 field

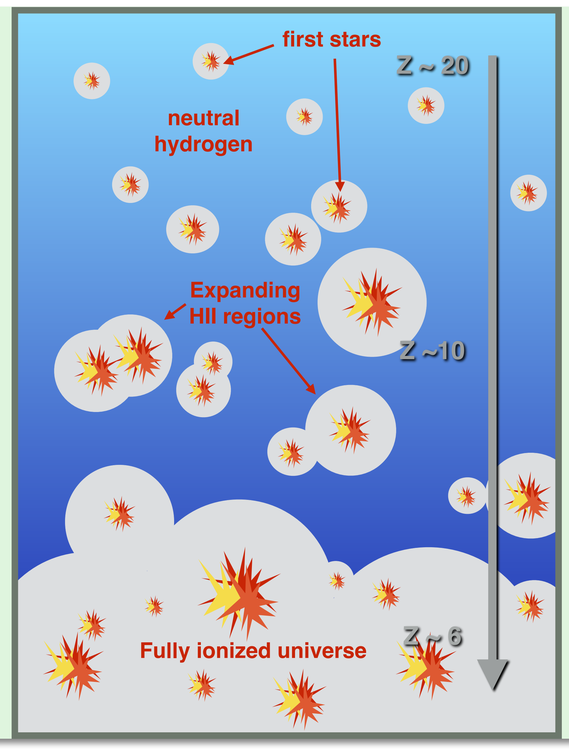
Geoffroy de la Vieuville
in collaboration with R. Pello, G. Mahler, D. Bina, J. Richard, N. Laporte and the MUSE collaboration
contact : gdelavieuvil@irap.omp.eu

Cosmic reionization

- Patchy reionization models (Becker+2015)
- **6 < z < 11 - 12**
- Enough UV photons to maintain the ionized state at z~6

- **Low mass, faint star forming galaxies**
- Lyman Alpha Emitters (LAEs) and Lyman Break Galaxies (LBGs)

Unknown relative contribution of those two populations to the reionization process

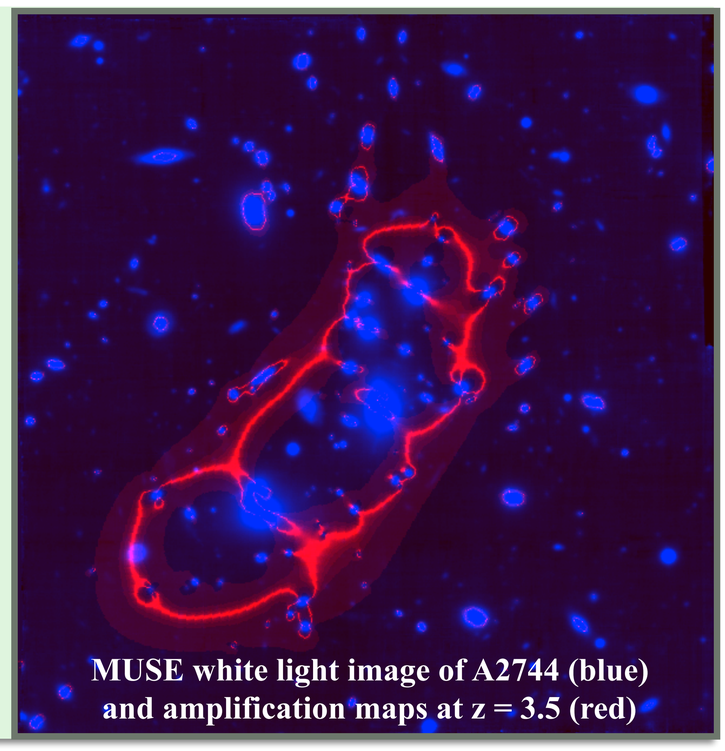


Observation strategies

- Use of lensing clusters, selected galaxies **10 - 100 fainter than in blank field survey**
- Explored volume decreases
- Robust mass model required (Lenstool, Kneib+ 1996, G. Mahler+2017 in prep.)

MUSE instrument

- **Integral Field Unit** (IFU)
- 1' x 1' field of view
- Very efficient for **emission line detection**
- Captures Ly_a emission between **z = 2.9 and 6.7**

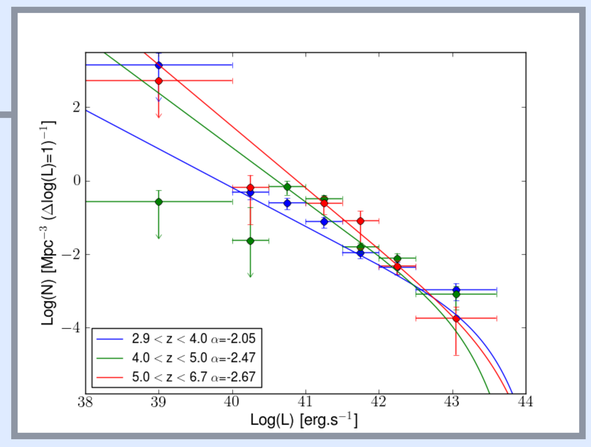

MUSE white light image of A2744 (blue) and amplification maps at z = 3.5 (red)

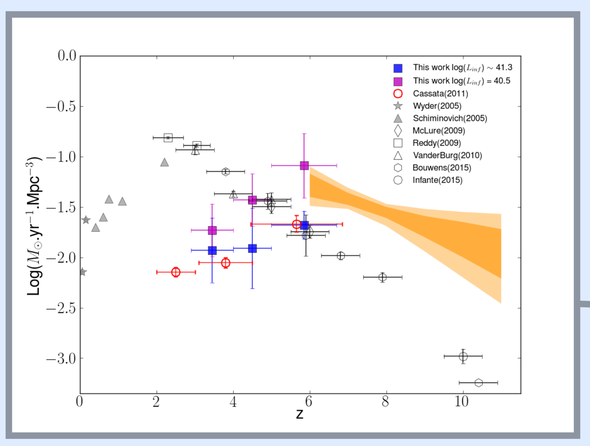
Recent results on the LAE luminosity function

Luminosity function

(on A1689, A2390, A2667, A2744) :

- 160 LAEs with :
  - **2.9 < z < 6.7**
  - **39.5 < $Log_{10}(L_{Lya})$ < 42.5**
- **Increasing steepness with z**



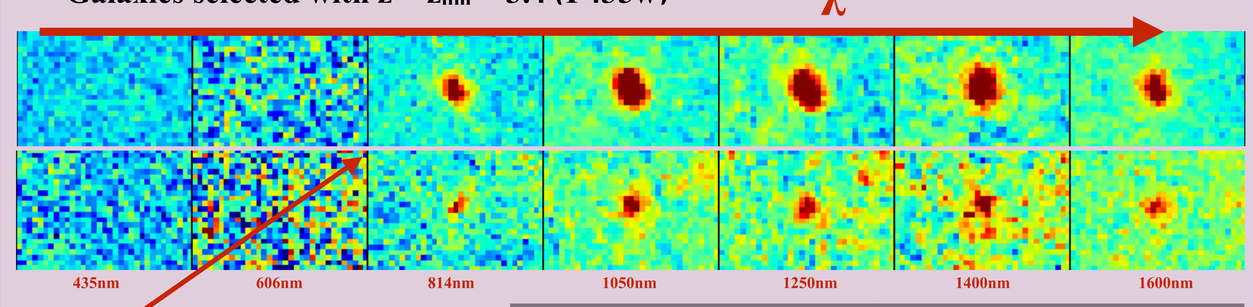


Sar formation rate density

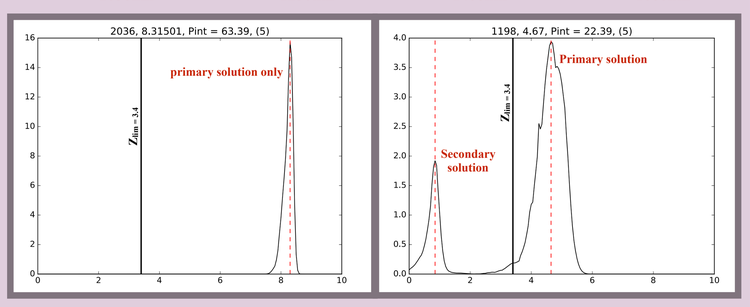
- Density of ionizing photons
- Dependent on integration limits (Schechter function)
- **LAE could be responsible for reionization at z~6** (D. Bina in prep.)

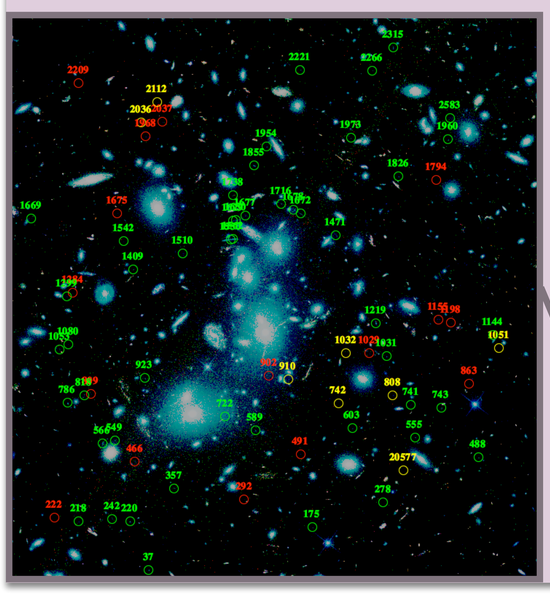
LBG selection

- First selection based on photometric break (98 candidates)
- **Galaxies selected with z > z_{lim} = 3.4 (F435w)**



- Second selection : photometric redshift and P(z)
- **SED fitting** outputs : P(z) used as a selection criteria and quality flag





Results of the LBG selection

Flag	LBGs	LAEs spectroscopically confirmed
1	13	0
2	5	0
3	8	2
4	20	5
5	52	15
secure LBGs	72	20

No correction for multiple sources yet

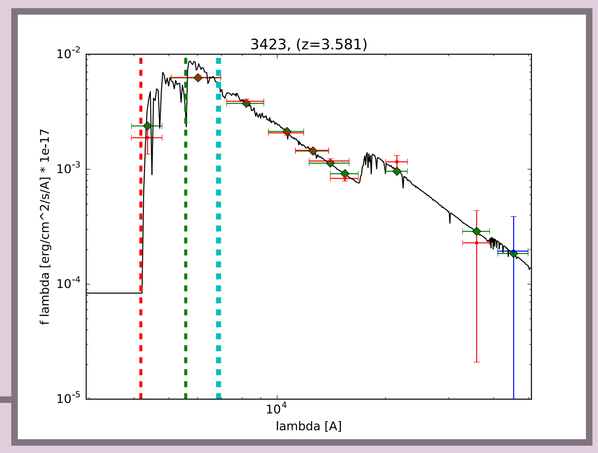
Secure LBGs overlaid on HST RGB image.
green : 3.4< z <4.5 , **red** : 4.5< z <5.5, and **yellow** : 5.5< z <8.3

LAEs characterization

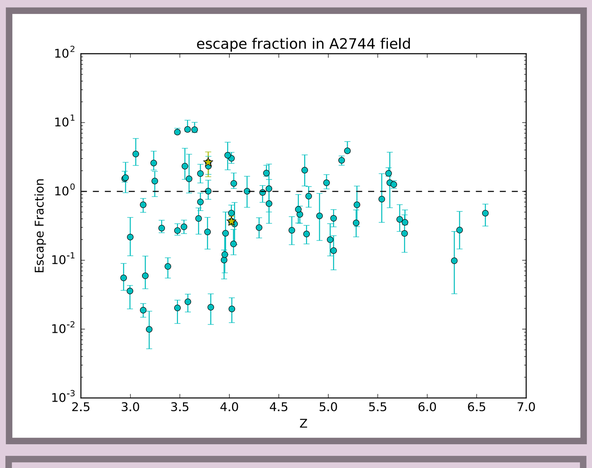
- Sample reduced to **A2744 : 132 LAEs**
- Astrodeep photometry (Merlin+2016, Castellano+2016) from **Hubble Frontiers Fields** (HST FF) observation program
- LAE detection catalog produced by G. Mahler

Process

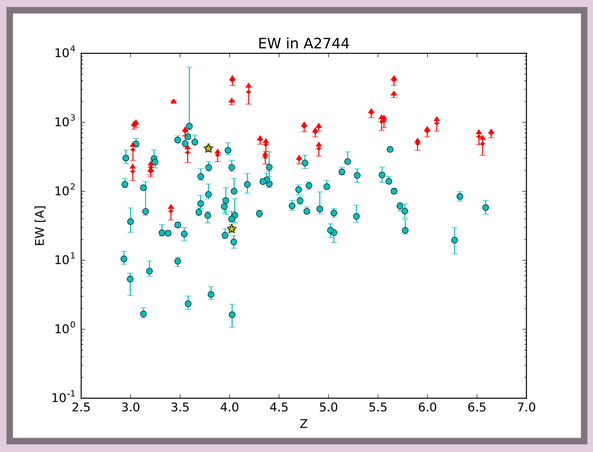
- lensing correction
- Monte Carlo iterations on photometry
- SED fitting with HyperZ (Bolzonella+2000)
- Dust correction
- **Resulting EW(Lya) and F_{escape}(Lya) population**



Example of SED fitting : **Red and green points** : real and synthetic photometry points, **blue points** : no detection, **red line** : Lyman-Break position, **green line** : Lya emission position and **cyan line** : UV continuum estimation position



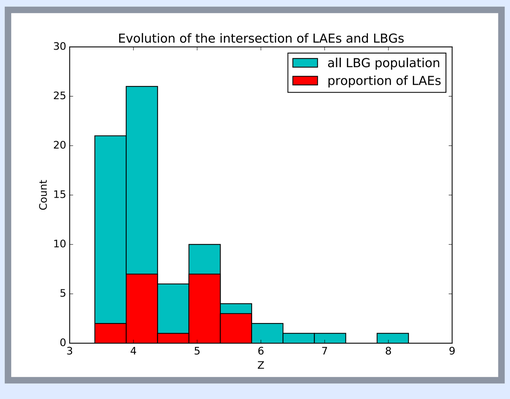
Lya escape fraction computed from our sample. The errorbars are computed from the resulting populations of the MC iterations



EW of the Lya emission from our sample. red points are galaxies for which no continuum is detected on HST FF images

Preliminary conclusion

- We selected a sample of **72 LBGs** behind A2744 field with 3.4< z <8.3
- On the **132 LAEs in A2744, 34 have no continuum** detection (25%) and in the intersection (78 galaxies) of the photometry catalog and the LAE detection catalog, **20 of them** (26%) **are selected as LBGs** as well
- On the **72 selected LBGs, 20 are spectroscopically confirmed LAEs** (28%)
- LAEs are likely to play a **predominant role in the reionization process** at z ~ 6



What's next

- Do the **lensing characterization** for the LBG selection

- Compute the **Luminosity function for the LBGs**
- Investigate the relative contribution of the two populations to ionizing flux
- Extending to **higher redshifts with EMIR**
  - Multi Object Spectroscope (0.9 - 2.5 μm)
  - GTC canary islands (10.4m diameter mirror)
- Apply same process to **other lensing clusters** observed by MUSE GTO

References :

D. Becker et Al. MNRAS, **2015**,447:3402-3419
J. -P. Kneib et Al. APJ,**1996**, 471:643-656
E. Merlin et Al. A&A, **2016**, 590, A30
M. Castellano et Al. A&A, **2016**, 590, A31
M. Bolzonella et Al. A&A, **2000**, 363, 476-492