Probing Ly-alpha emission and models with GRBs

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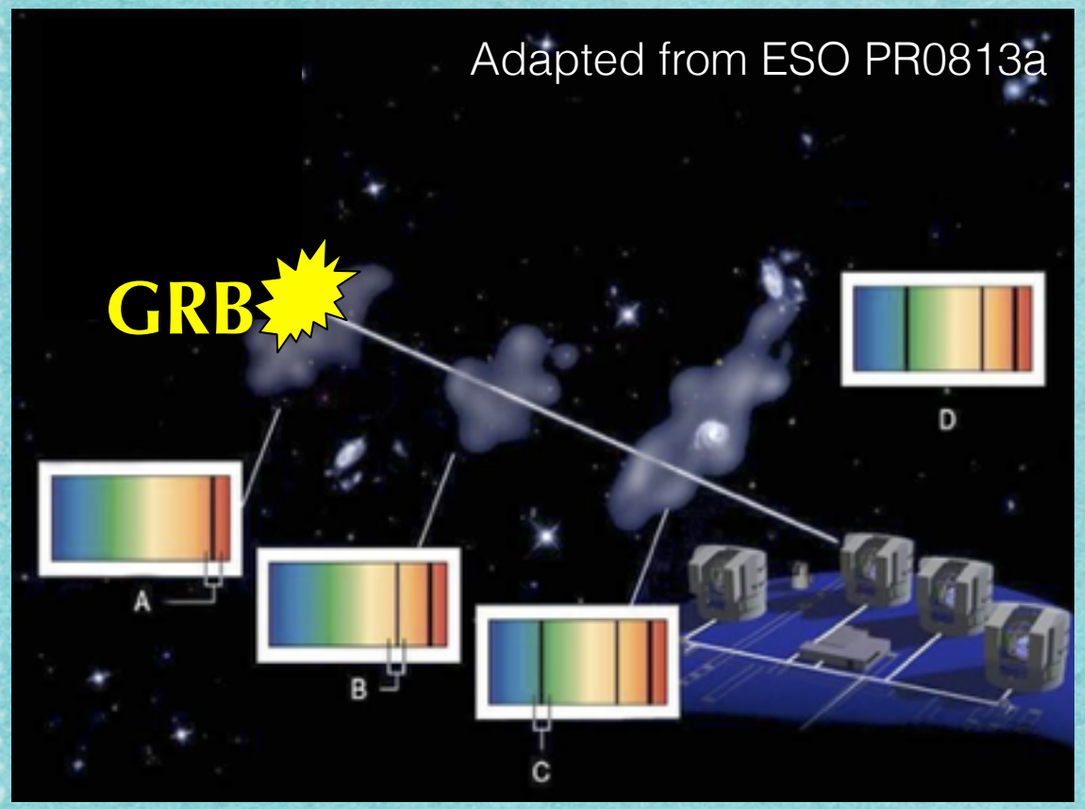
GRBs: AFTERGLOW SPECTROSCOPY

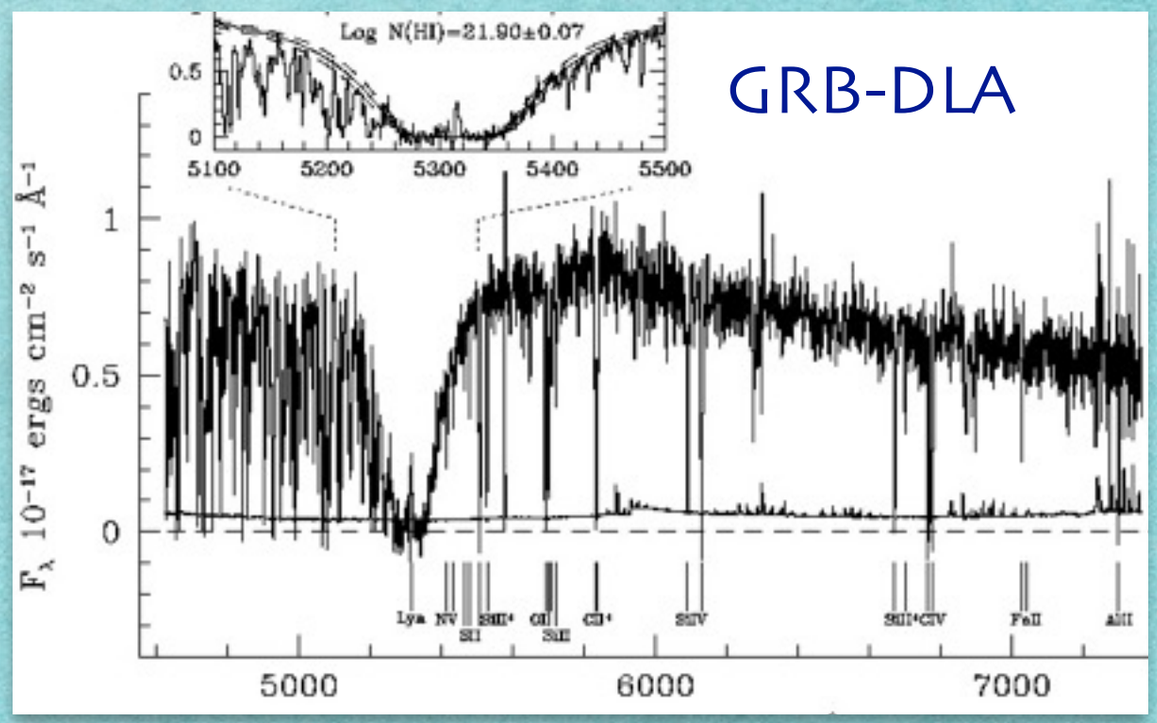
Detection: gamma rays

Bright optical (NIR) afterglow also at (very) high z

Transients

WR as progenitor stars

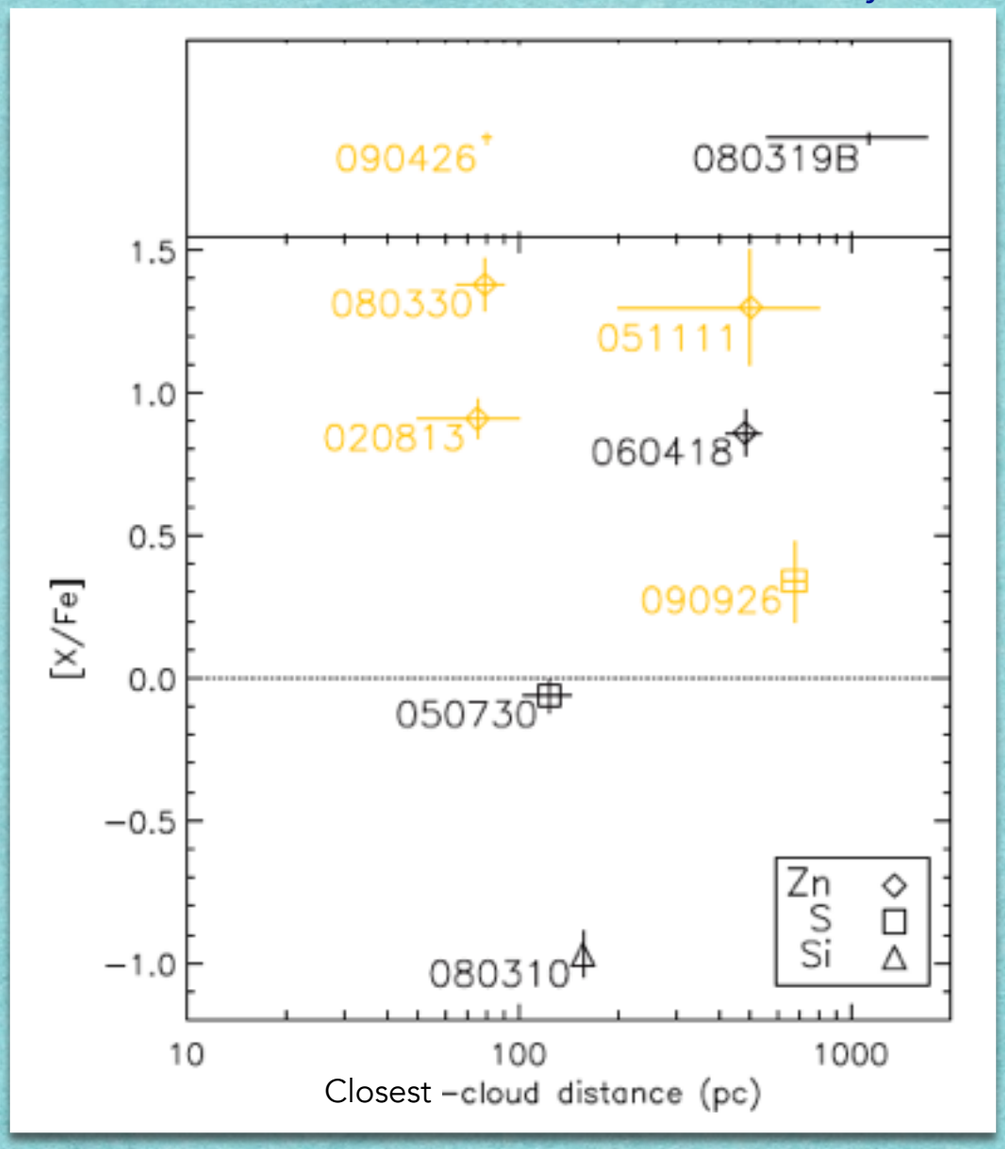




GRB030323 z=3.372 Vreeswijk+04

GRBs: AFTERGLOW SPECTROSCOPY

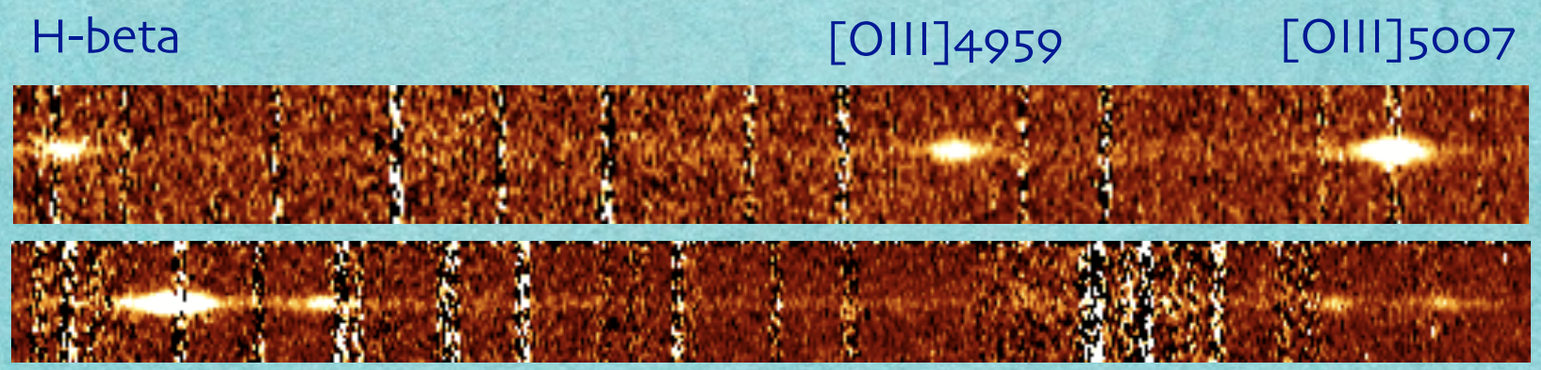
Vreeswijk+12



We are probing the star-forming regions
(but not the circumburst environment)

GRBs: HOST GALAXY SPECTROSCOPY

Very precise GRB afterglow position (~")
We know were the GRB-DLA counterpart is
(GRB host galaxy)



GRB070306 z=1.49

THE POPULATION OF GRB HOST GALAXIES

- Star-forming galaxies
- not luminosity selected
- extend to faint galaxies & high z
- cold/warm gas + ionized gas
- HI, metallicity, dust,…
- kinematics
- inflow/outflow
- systematically & at any z!

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$M_{star} < 10^{10} M_{sun}$

$Z < 0.7 Z_{sun}$

SFR ~10-50 M_{sun}/yr

size ~few kpc

log(sSFR/yr) > -9

- HI, metallicity, dust,…
- kinematics
- inflow/outflow
- systematically & at any z!

GRB HOST LAE

- Systemic redshift, nebular lines
- N[HI]
- Lyα emssion (peak, FWHM, EW…)
- Hα
- V_{LIS}
- systematically (1.8≲z≲4)

Carachterize Ly-alpha emitting galaxies at z~2-3 (different selection)

Test Ly-alpha models

GRB HOST LAE

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- systematically ($1.8 \lesssim z \lesssim 4$)

GRB HOST LAE 10% —>low numbers :(

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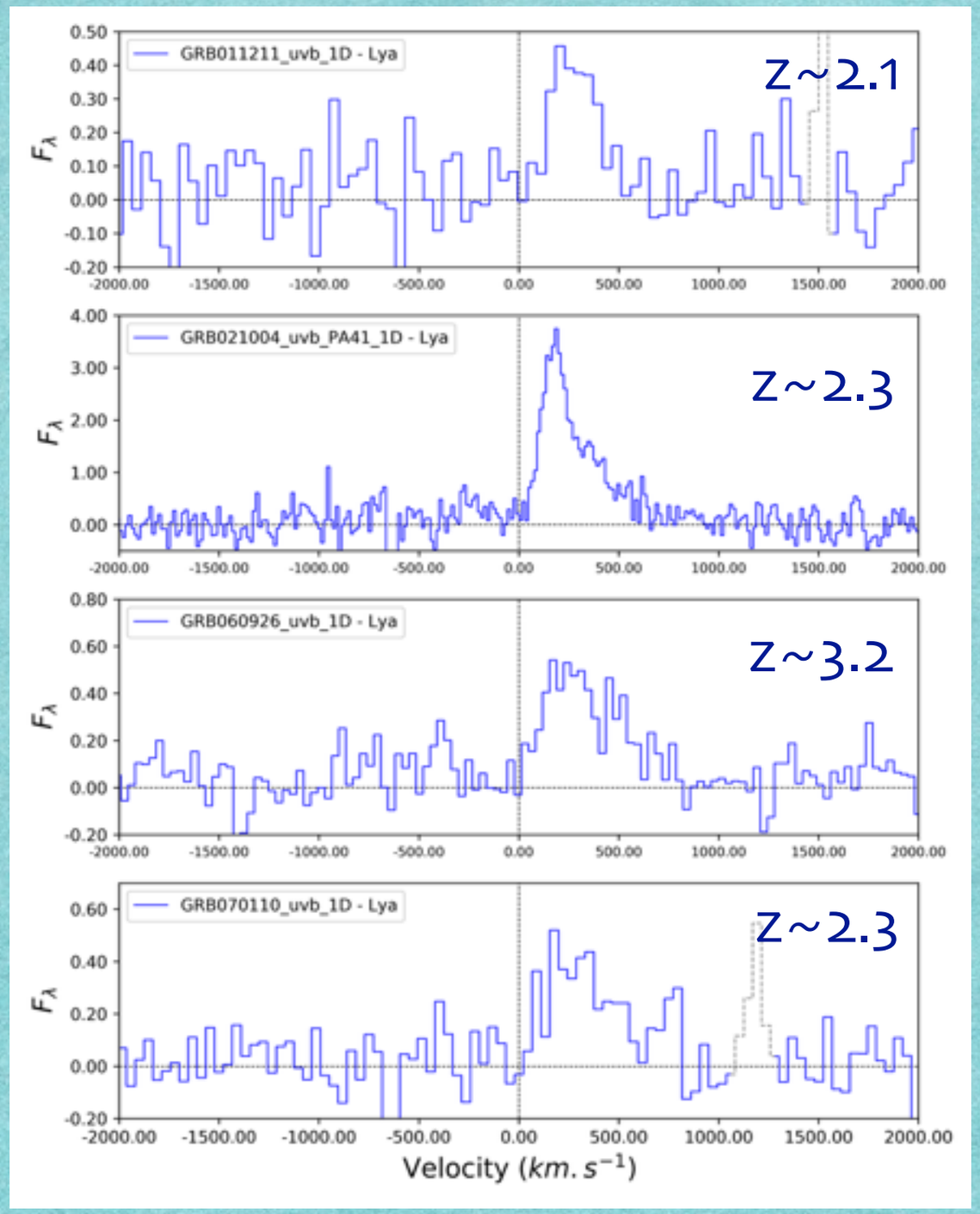
Test Ly-alpha models

GRB HOST LAE



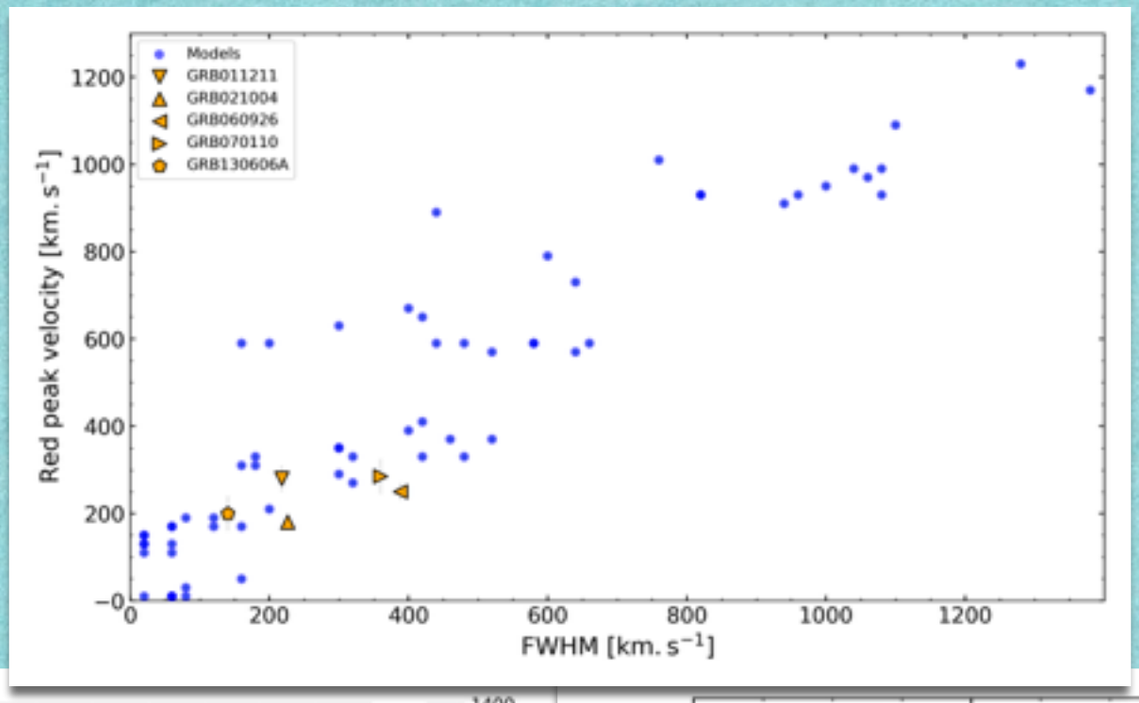
$f_{esc}(Ly\alpha) > 0.2$

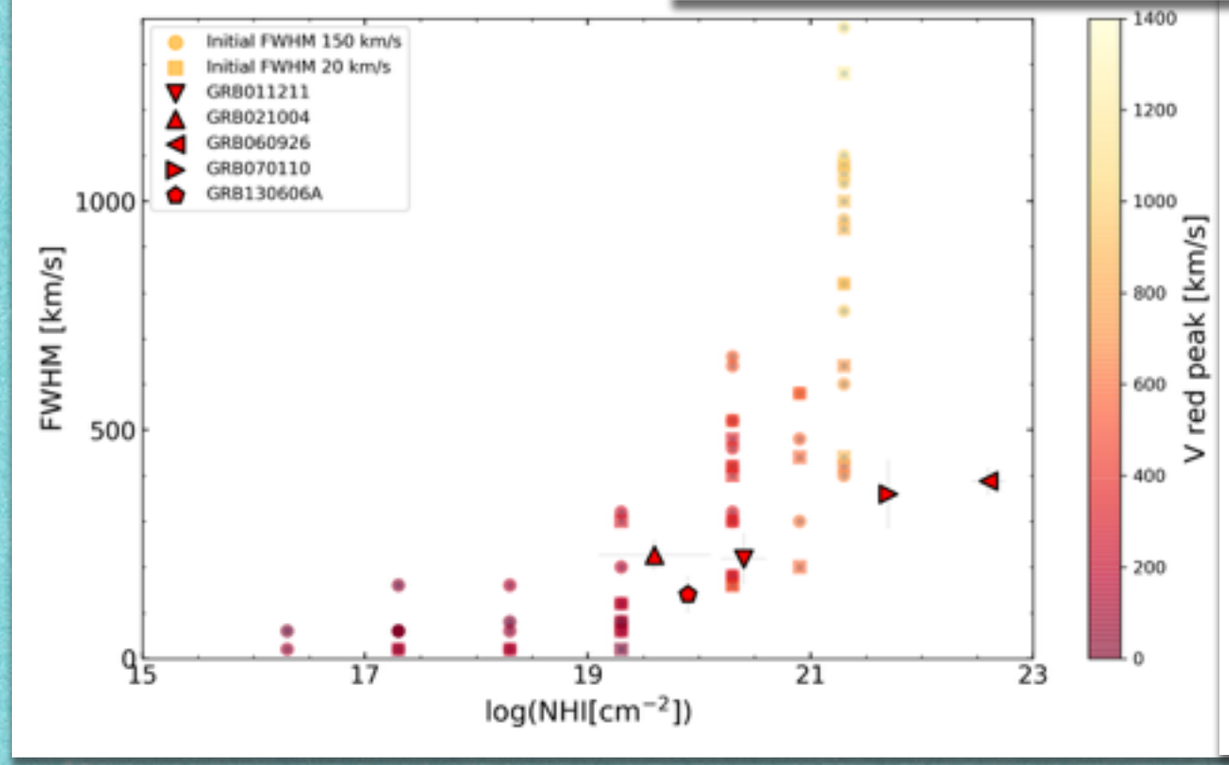
$f_{esc}(Ly\alpha) = 0.6$

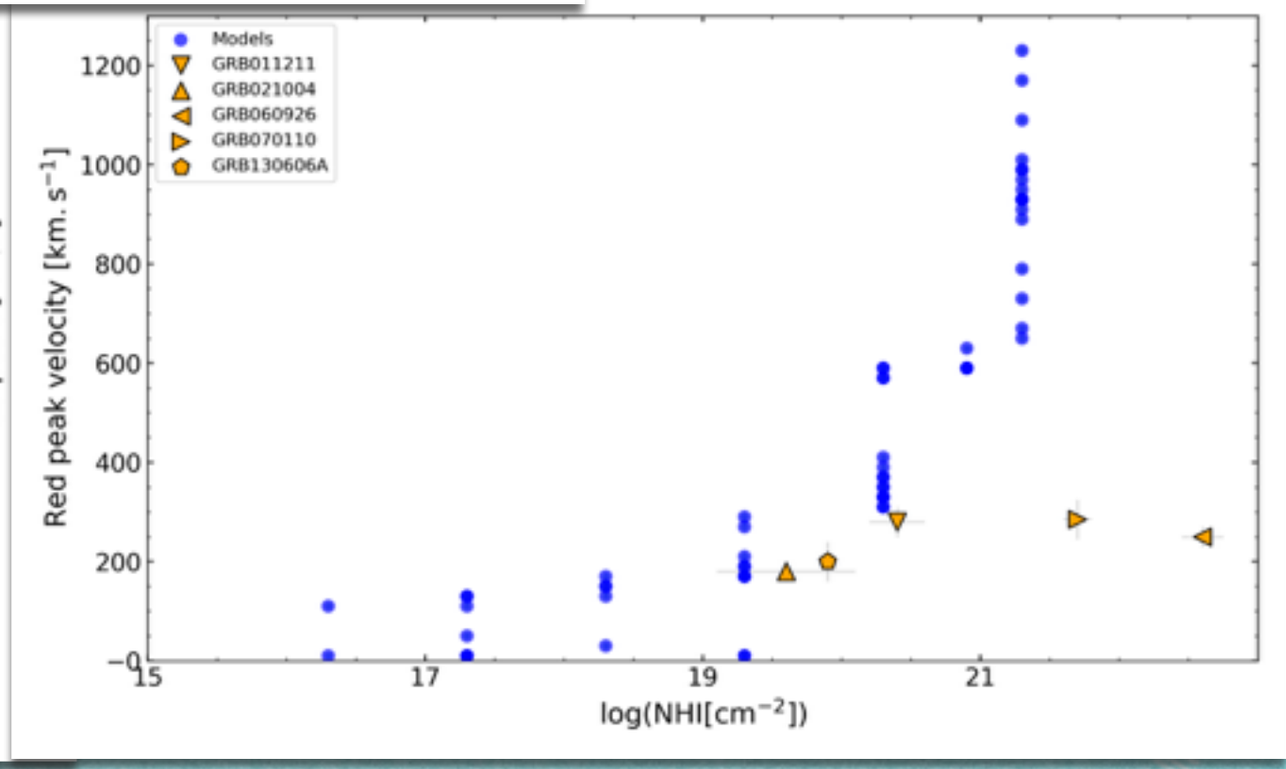
$f_{esc}(Ly\alpha) > 0.1$

$f_{esc}(Ly\alpha) = 0.4$

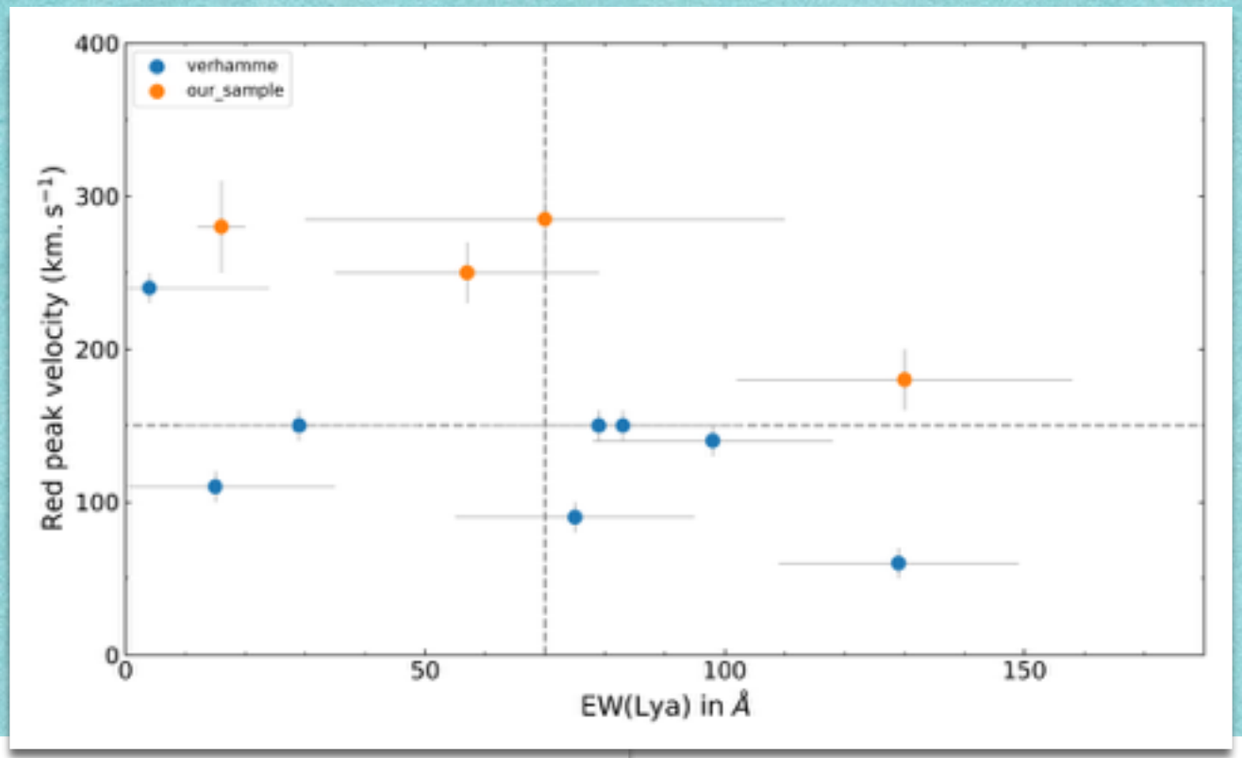
GRB HOST LAE: comparison with model predictions

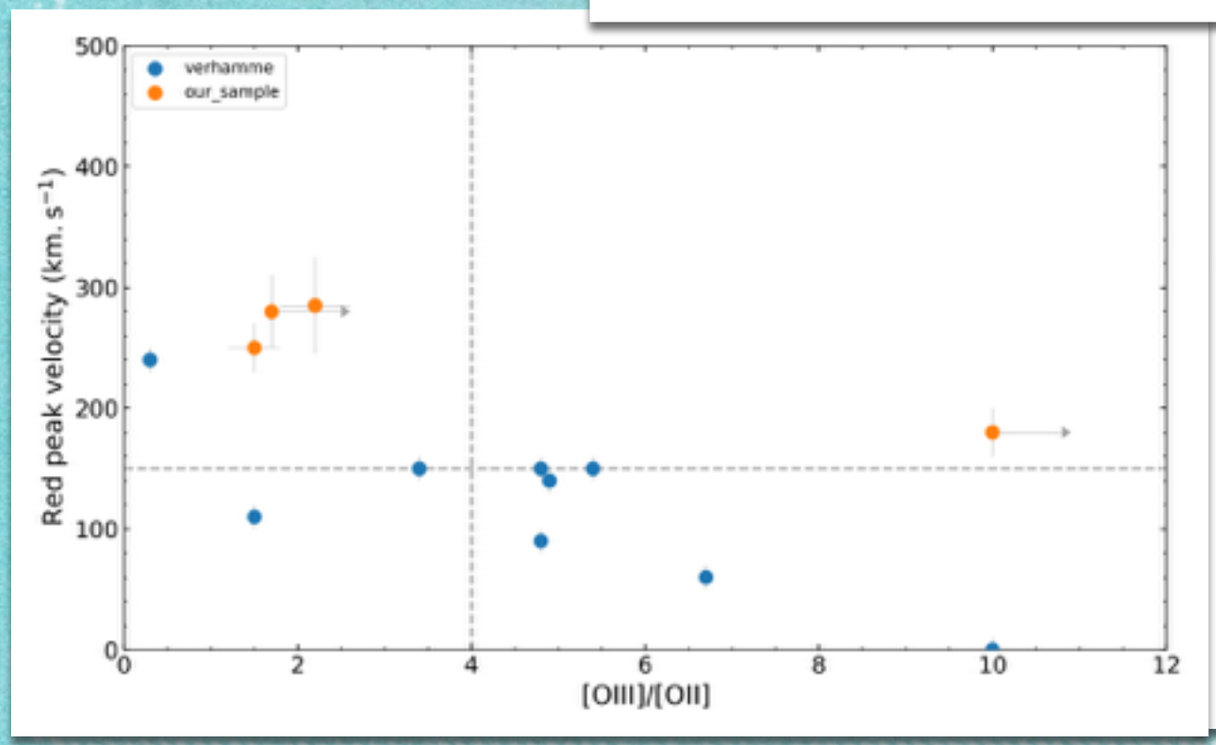


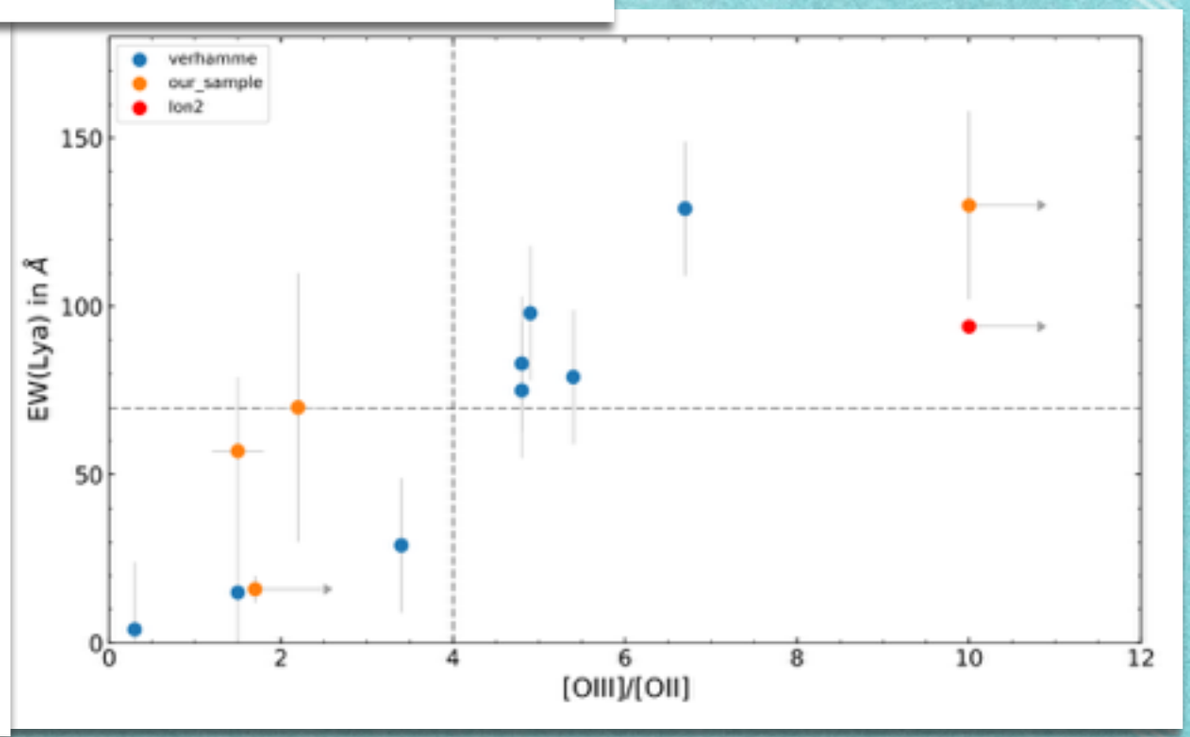




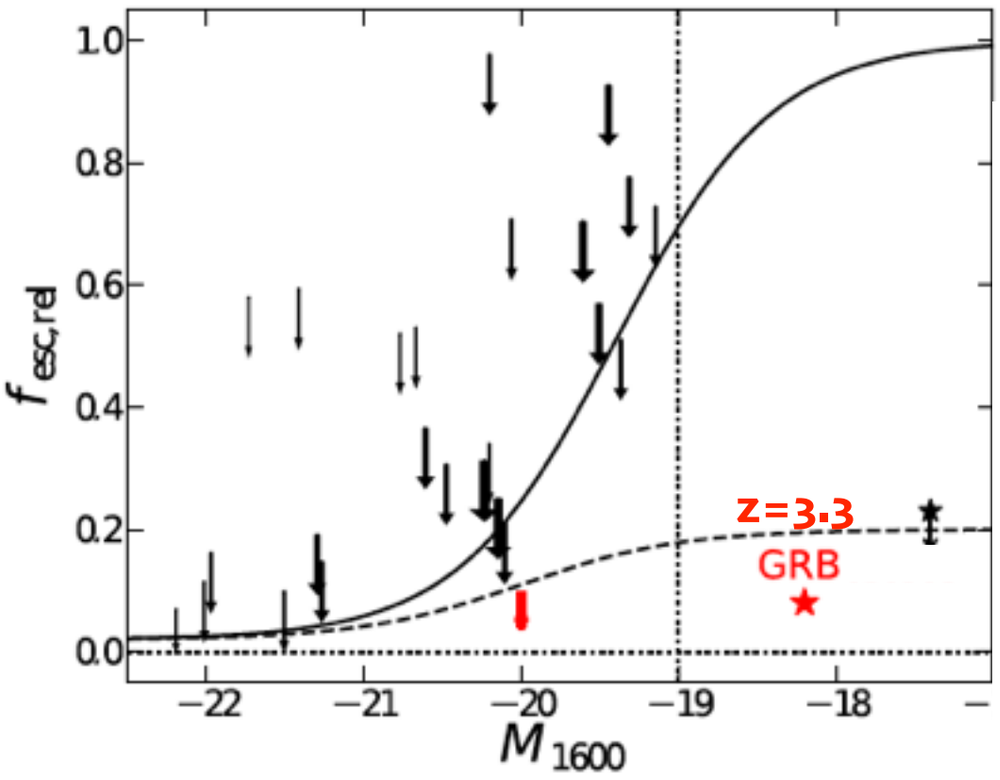
GRB HOST LAE: comparison with GP leakers





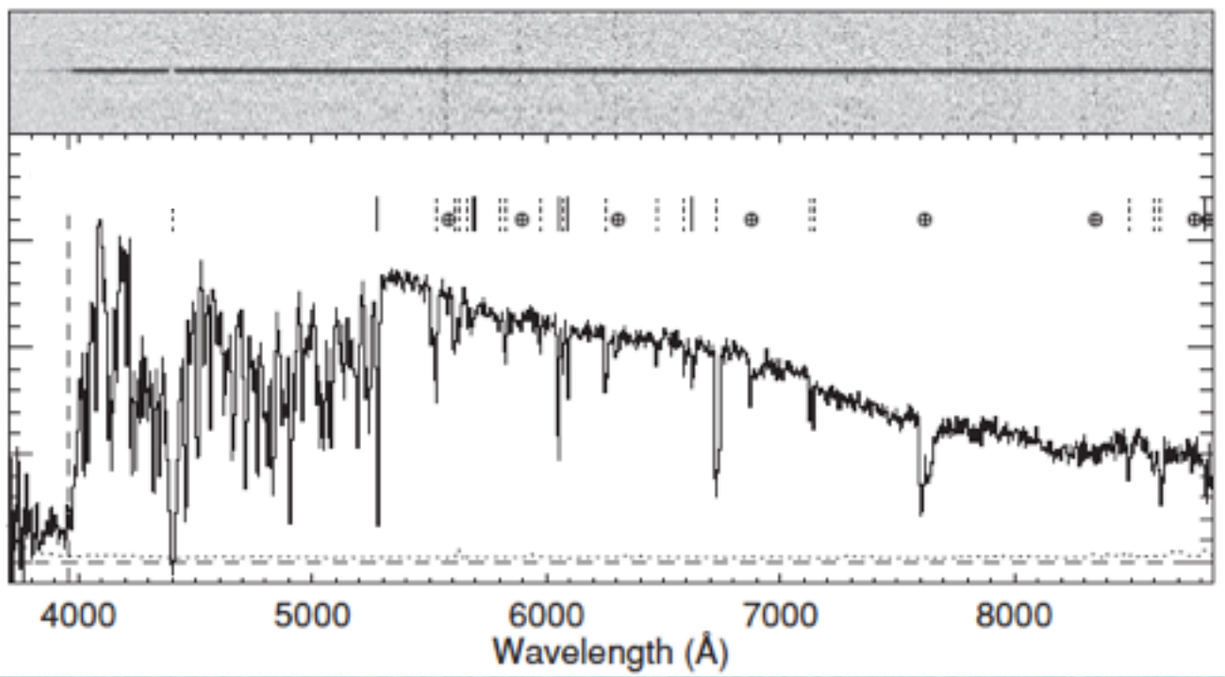


GRB HOSTS: Lyman Continuum Leakers



Adapted from Japelj+17

log(NHI/cm^{-2})=17.6

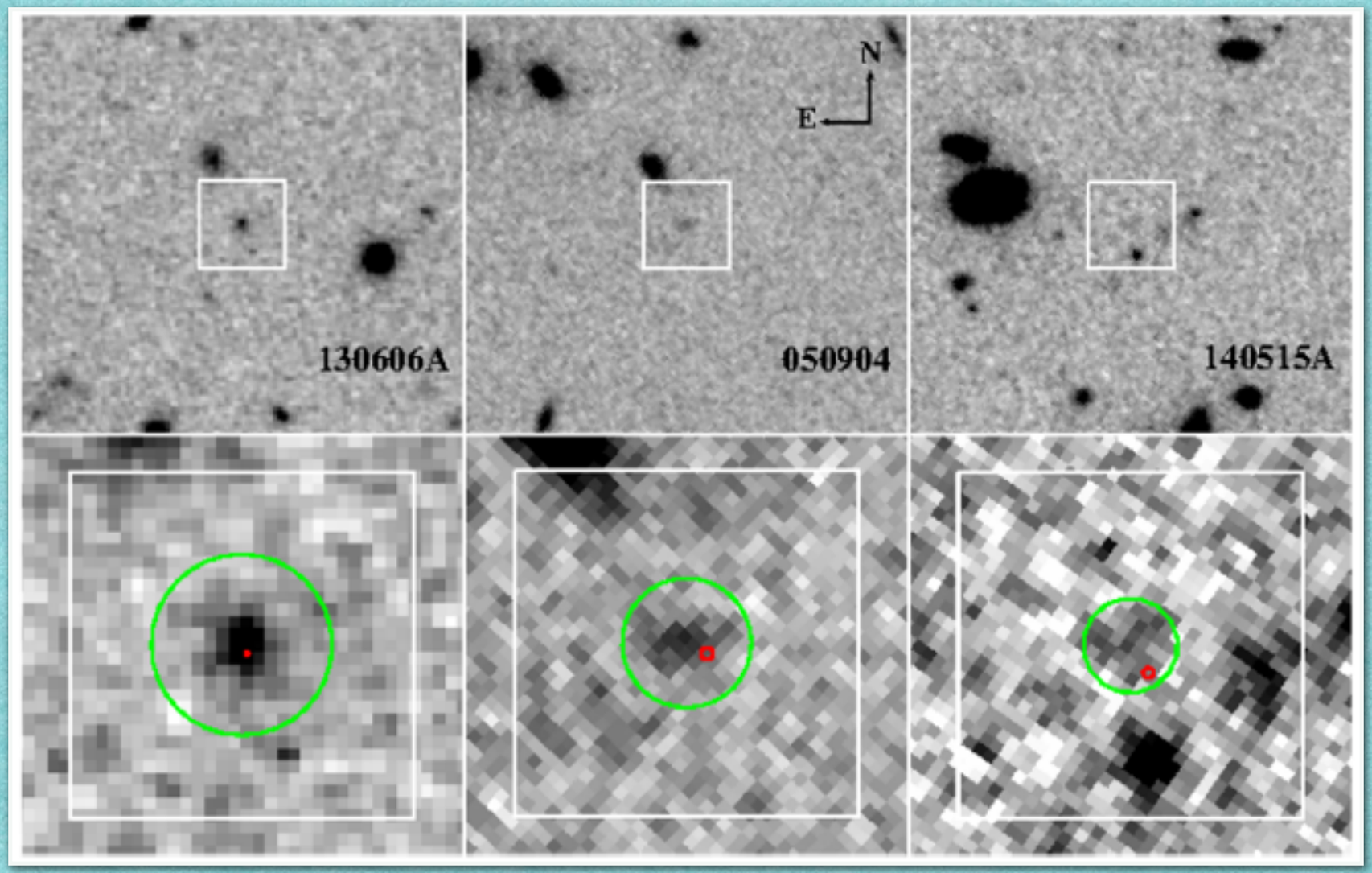


Fynbo+09

Need of Xshooter time
to observe the host galaxy emission lines

GRB HOST GALAXIES AT VERY HIGH REDSHIFT

McGuire+16



Identifier	130606A	050904	140515A[a]
$m_{\lambda_{obs}}$ (mag)	$26.34^{+0.14}_{-0.16}$	$27.56^{+0.18}_{-0.22}$	$28.30^{+0.25}_{-0.33}$

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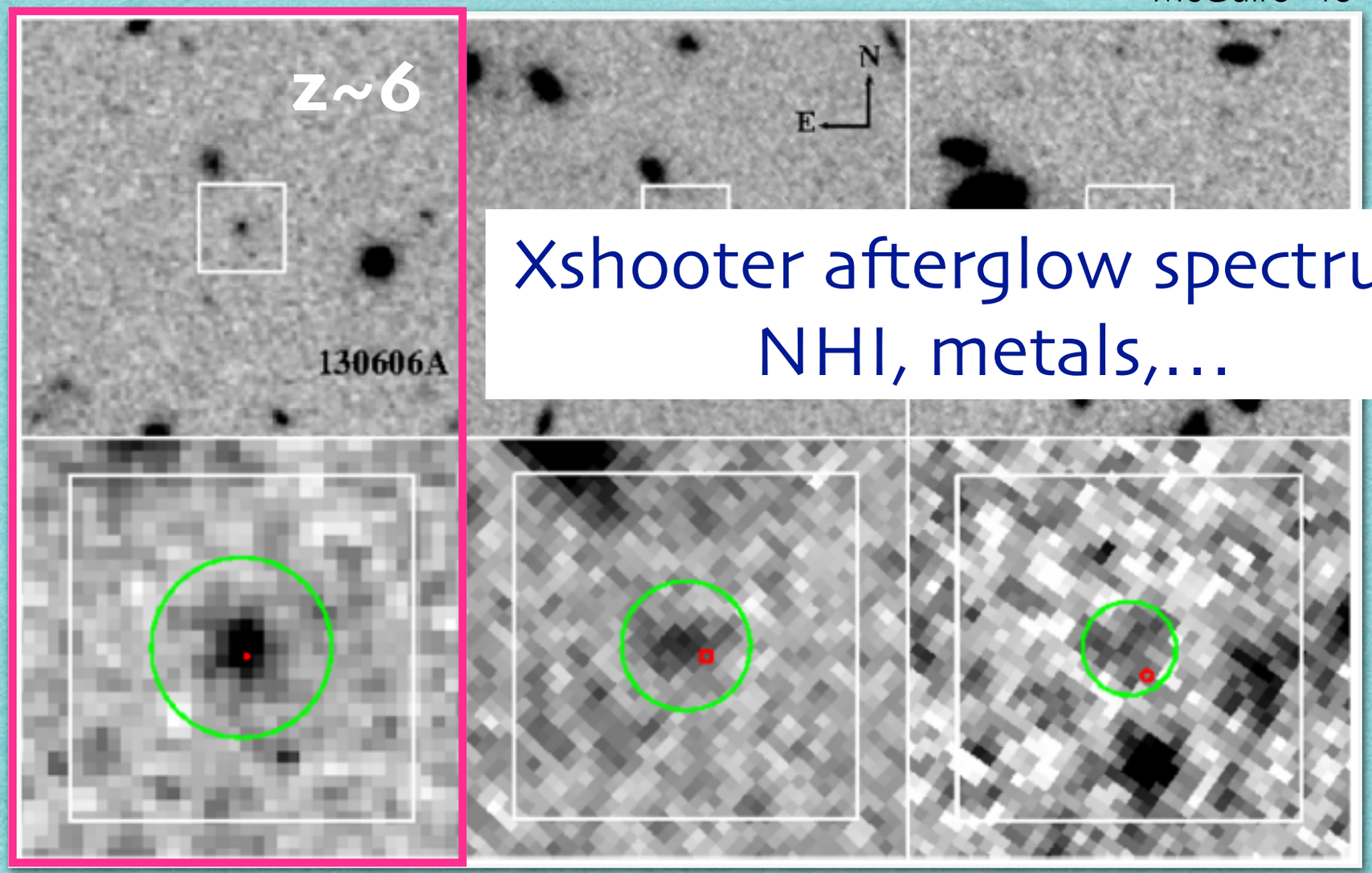

Xshooter afterglow spectrum:
NHI, metals,…

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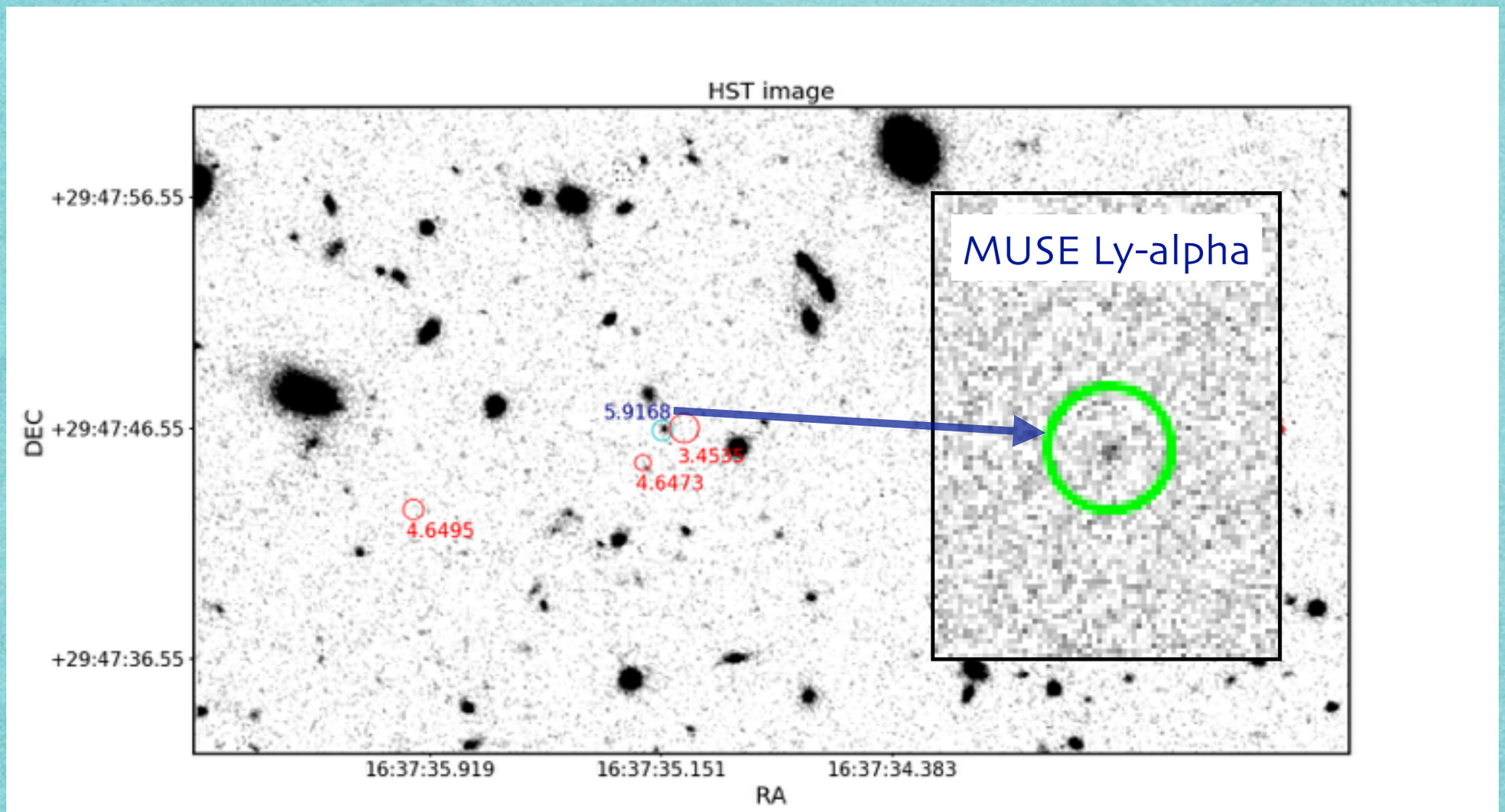
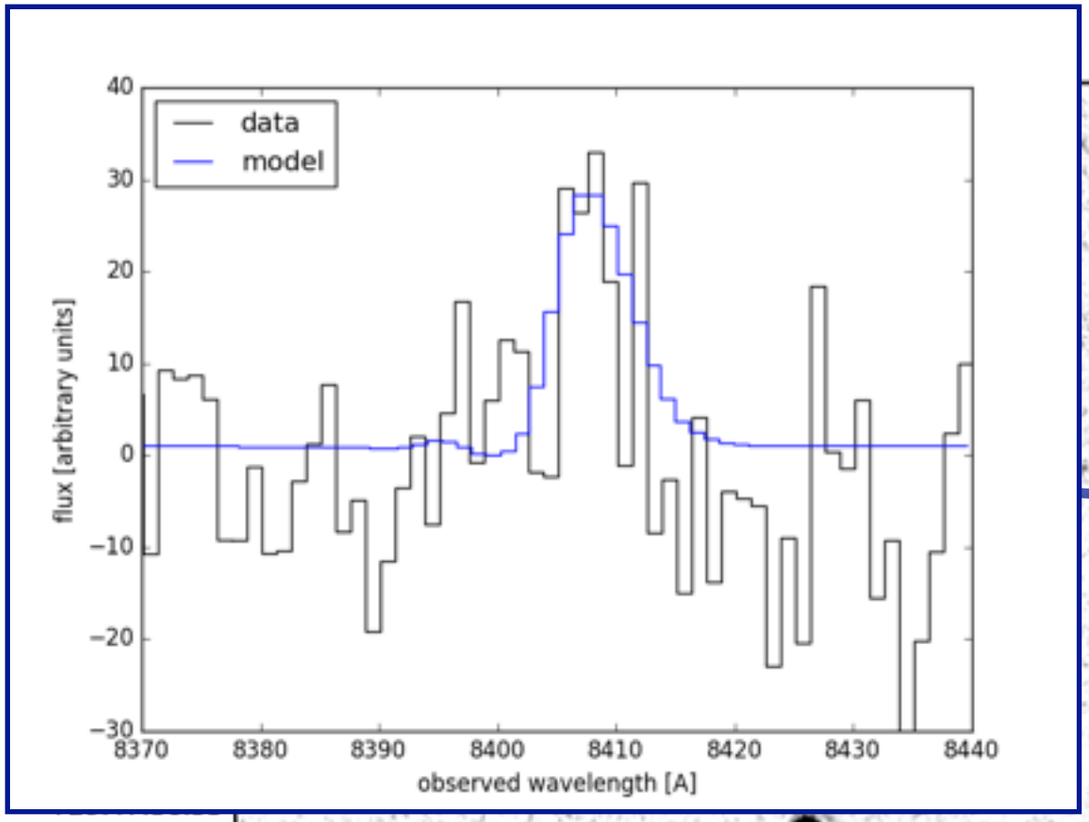


The only object at high redshift having information on HI, metals, continuum and emission lines

JWST to detect nebular lines

GRB HOST GALAXIES AT VERY HIGH REDSHIFT



The only object at high redshift having information on HI, metals, continuum and emission lines

Need of MUSE time to obtain a better S/N

CONCLUSIONS

- GRBs allow a different selection of LAE or LyCont leakers
- Low numbers but lot of information
- Tools to test Ly-alpha models, compare with simulations
- up to the highest redhsifts and to the faintest galaxies

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