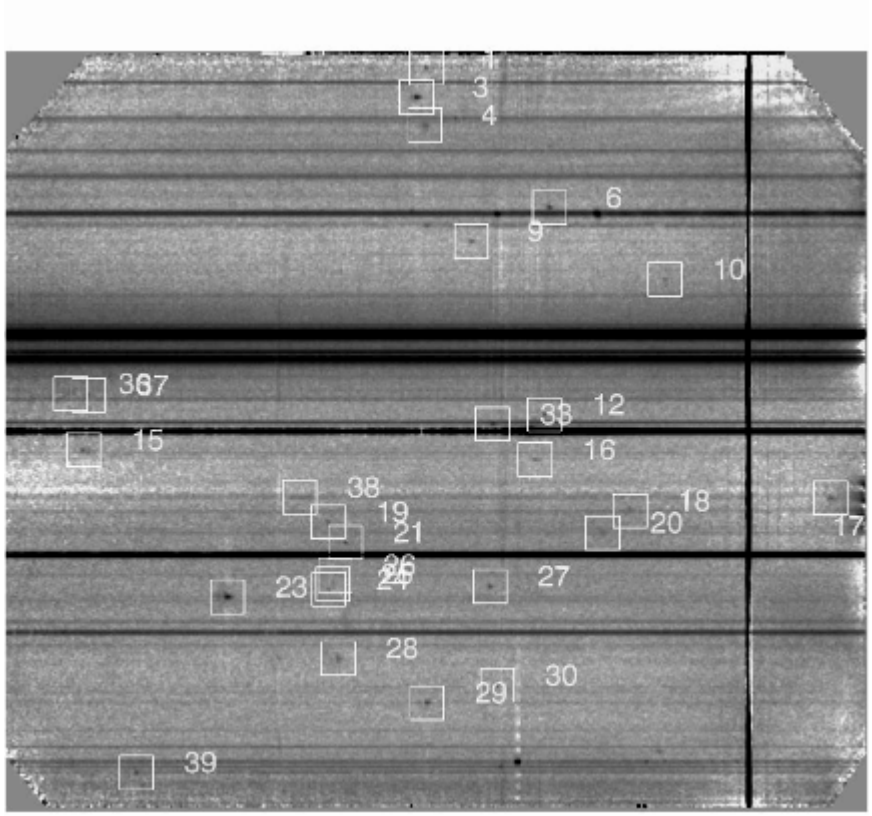


Probing outflows/inflows from DLA host galaxies with spatially extended Lyα emission

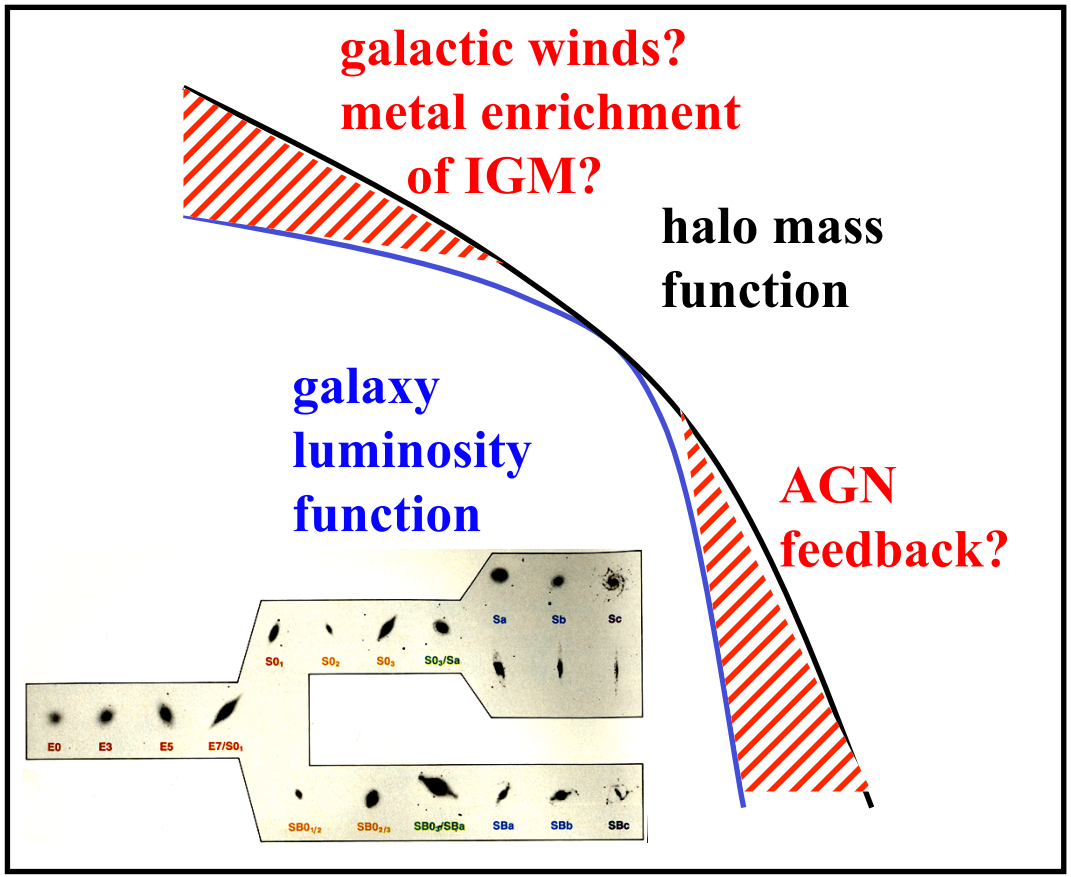
Martin Haehnelt

in collaboration with:

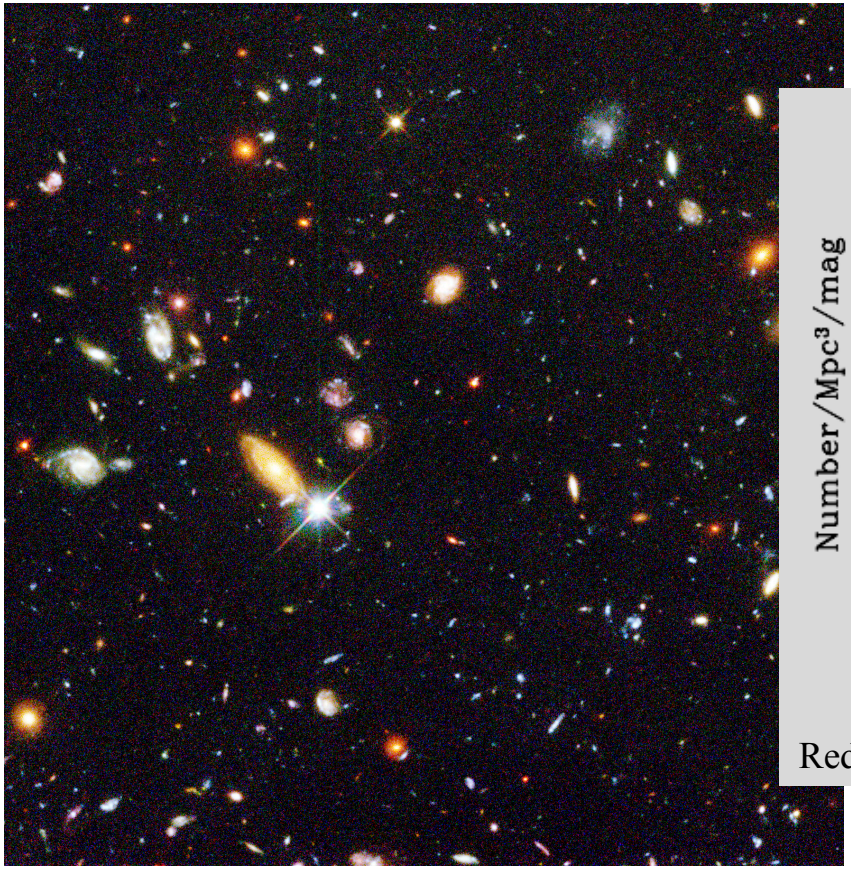
Luke Barnes , Michael Rauch,

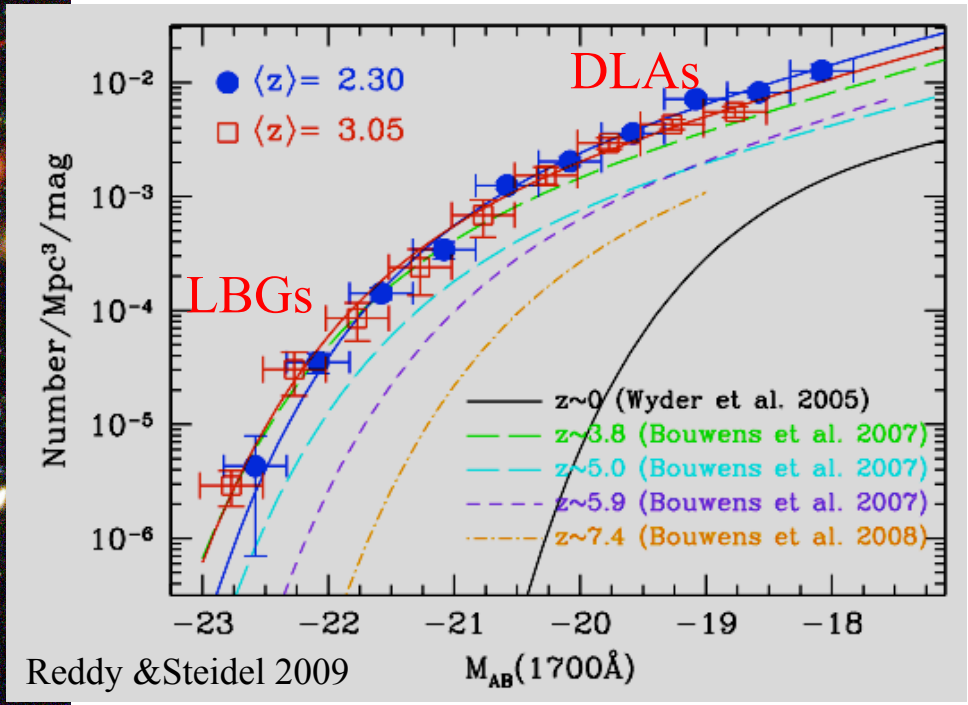
George Becker , Wal Sargent, Edoardo Tescari, Matteo Viel

Durham, 21 July 2011



Low mass galaxies
at high redshift should
reveal important clues on
- how feedback works and
- how gas gets into galaxies





Reddy &Steidel 2009

DLAs should populate the extreme faint end of the LBG populations

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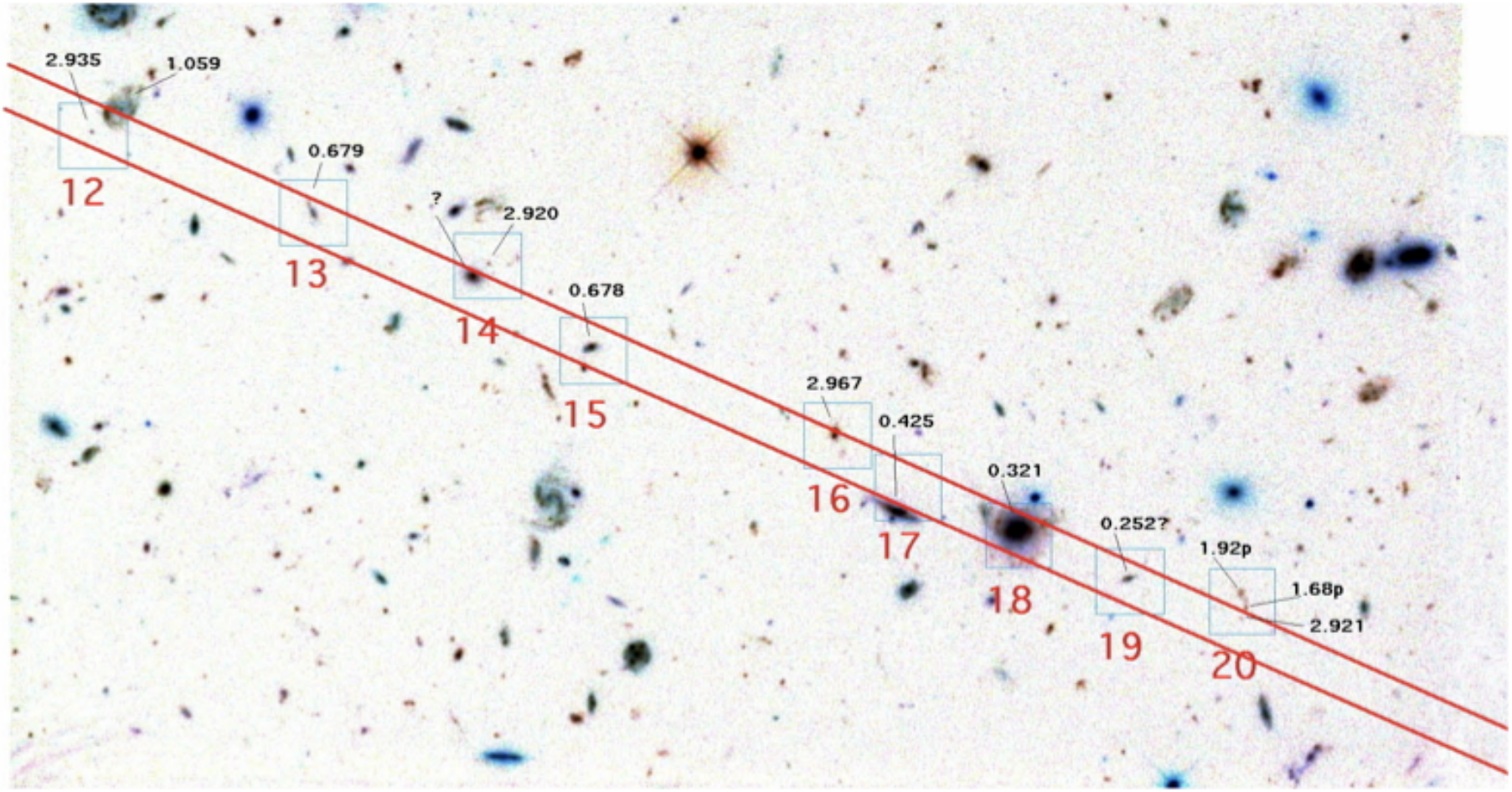
Blind ultra-deep longslit spectroscopy



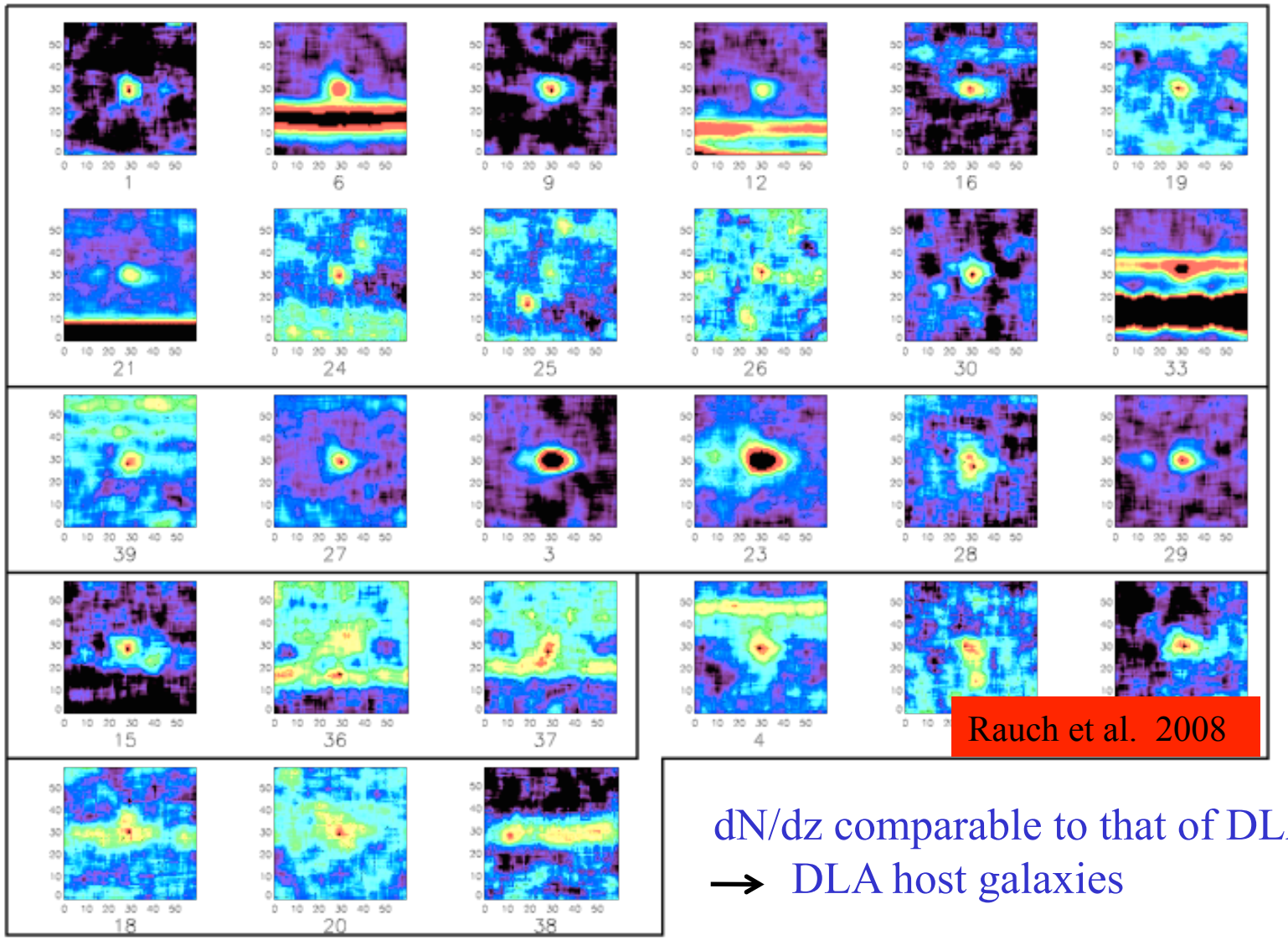
Michael Rauch et al.

Durham, 21 July 2011

2300 km/s

116kpc

27 spatially extended Lyα emitters at 2.6<z<3.6



Rauch et al. 2008

92 hours in a blank field with FORS!

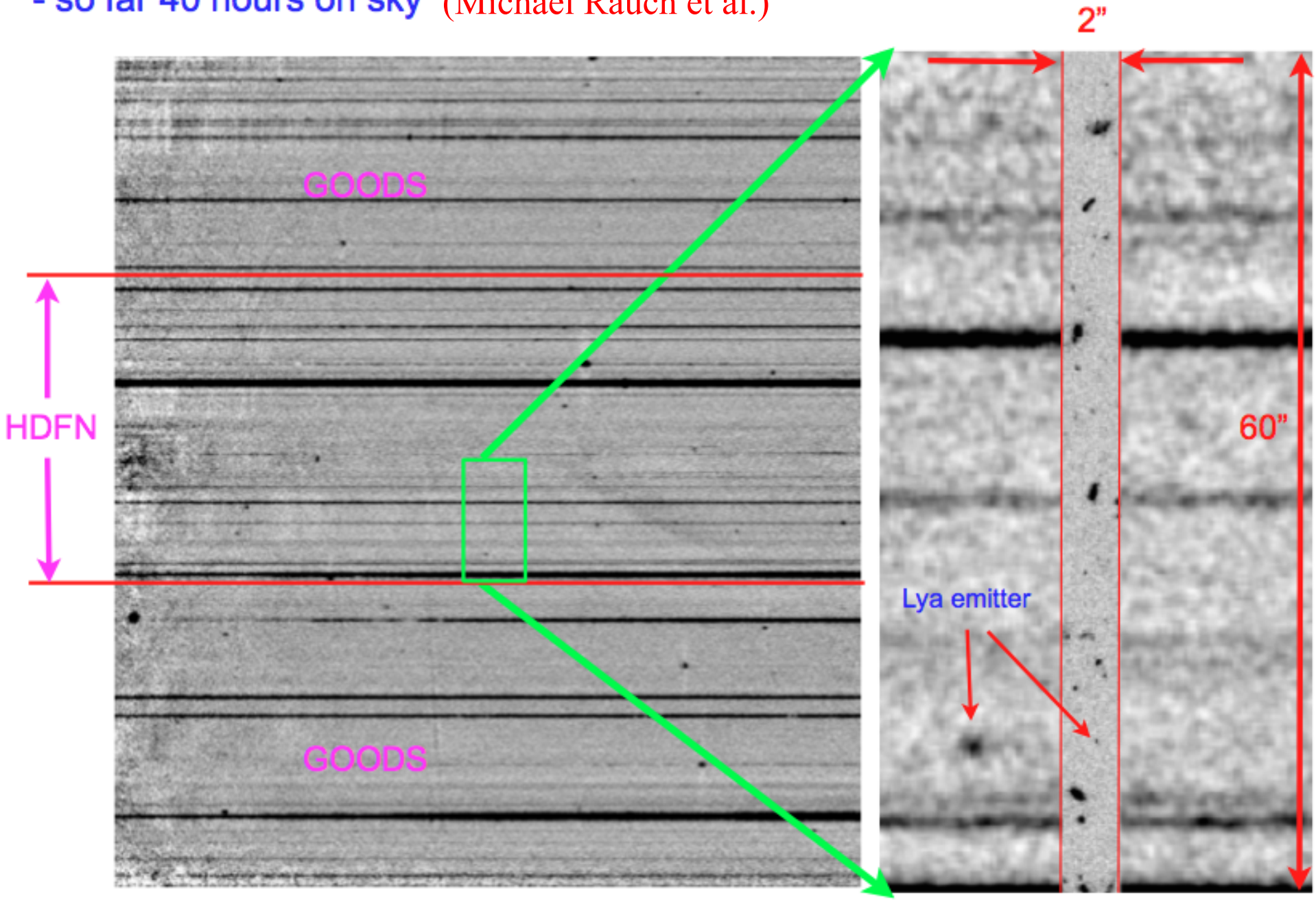
dN/dz comparable to that of DLAs

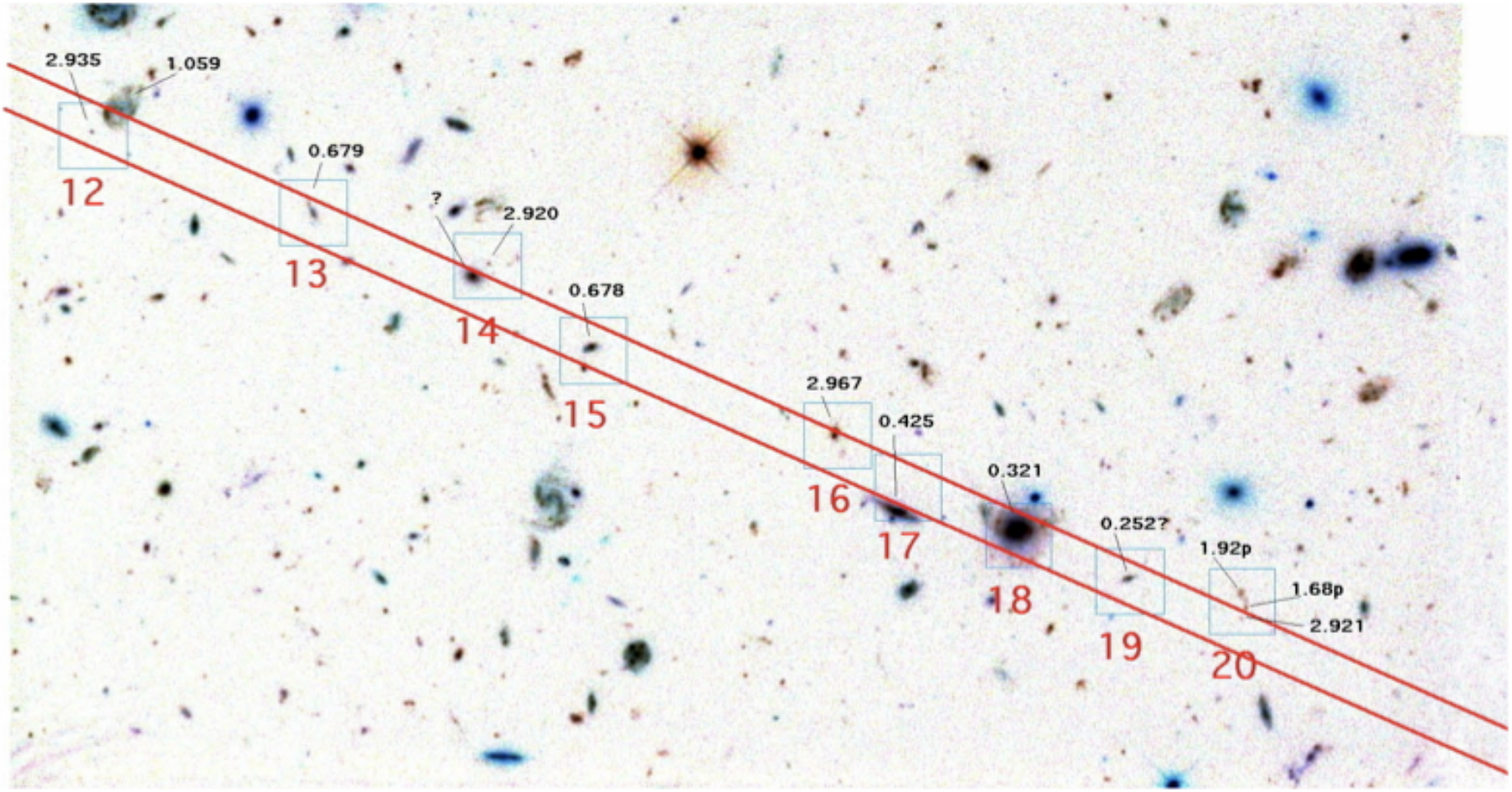
→ DLA host galaxies

space density: $3 \times 10^{-2}\ h_{70}^{3}\ \mathrm{Mpc}^{-3}$

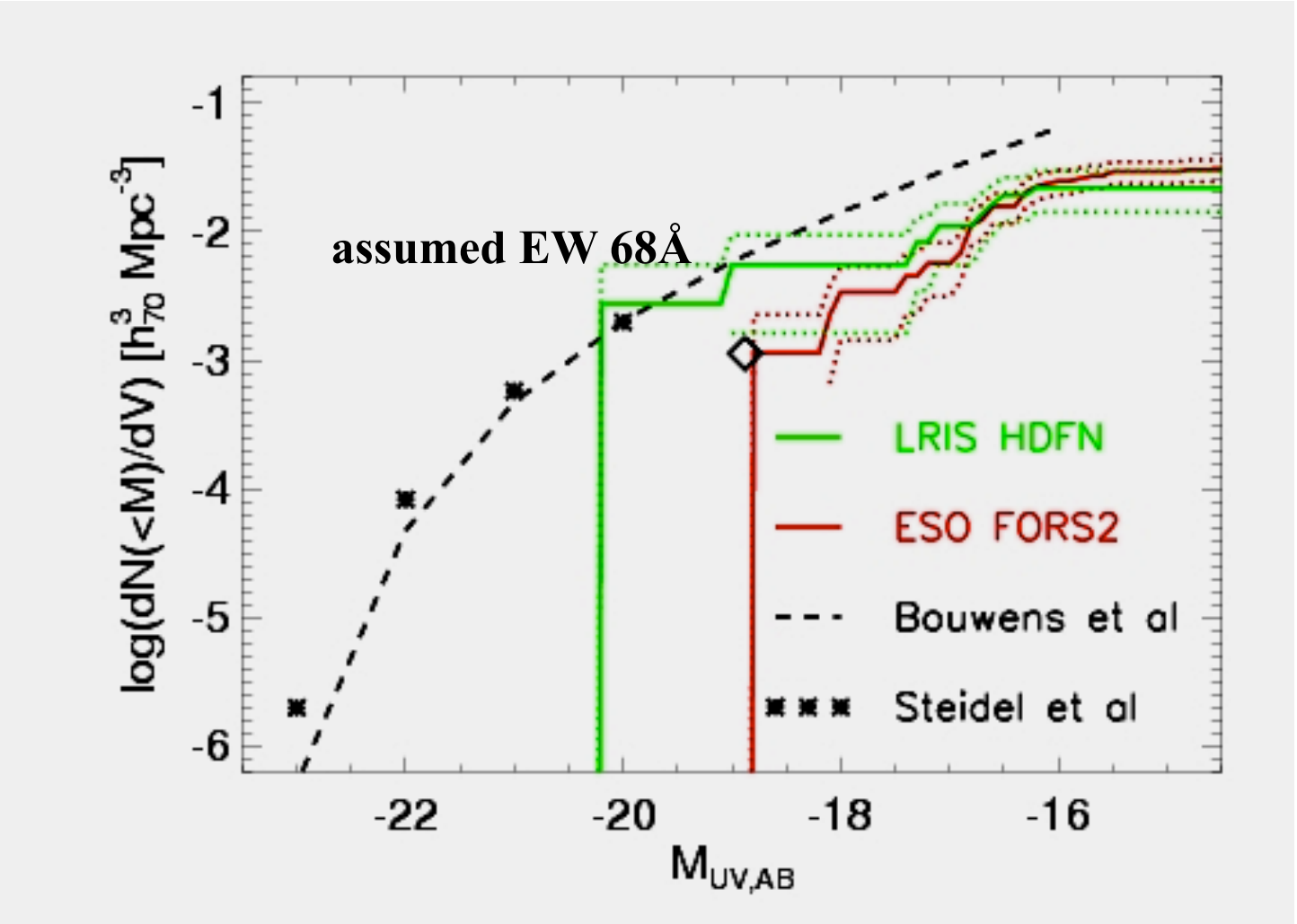
IoA UNIVERSITY OF CAMBRIDGE

- Keck LRIS LS spectroscopy of the Hubble Deep Field North
- so far 40 hours on sky (Michael Rauch et al.)





Continuum counterparts are compact and indeed from the very faint end of the LBG population.



The emitters are as abundant but fainter as B dropouts in the HUDF!

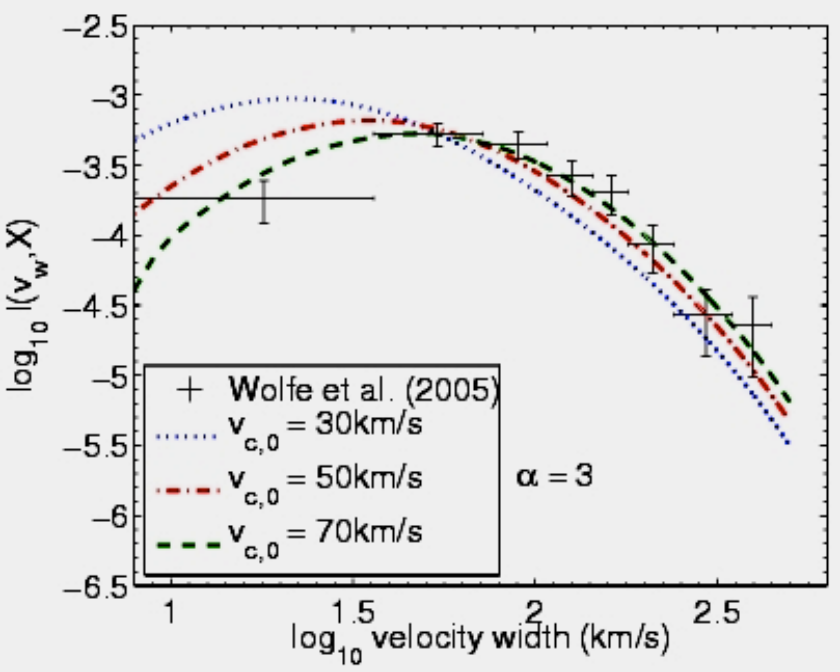
Durham, 21 July 2011

Rauch et al. 2008
Haehnelt et al 2008

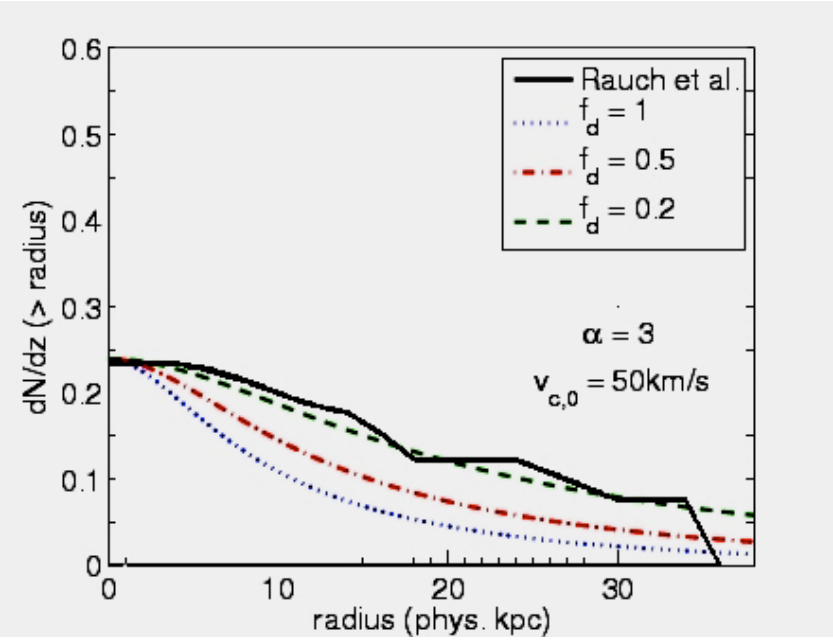
A joint model for the emission and absorption properties of damped Lyα absorption systems

Luke A. Barnes* and Martin G. Haehnelt
Institute of Astronomy, Madingley Road, Cambridge, CB3 0HA

velocity width distribution



cumulative incidence rate



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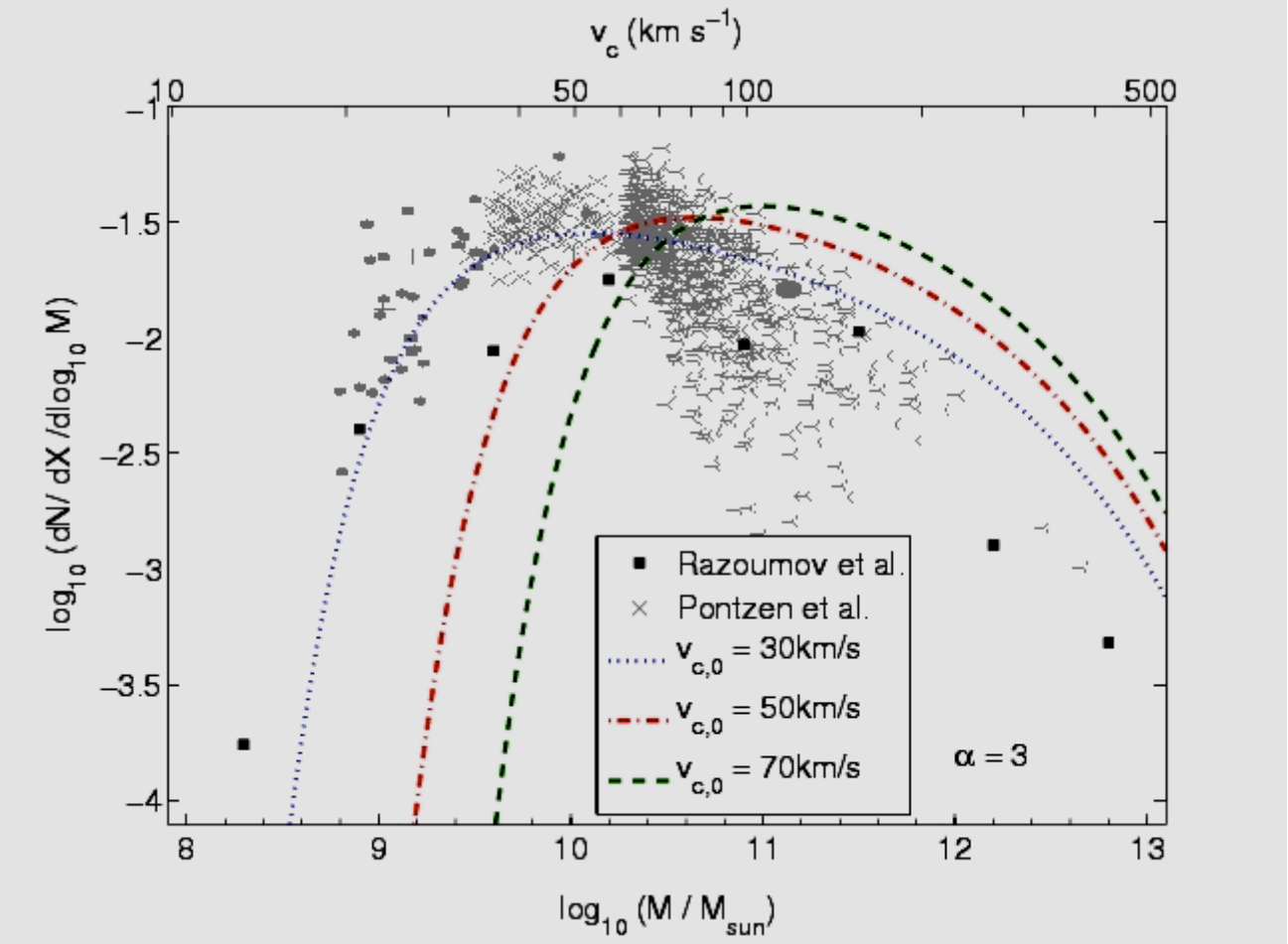
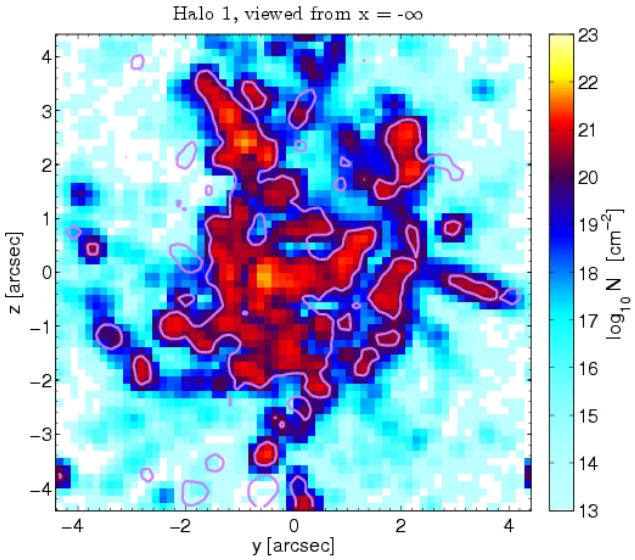
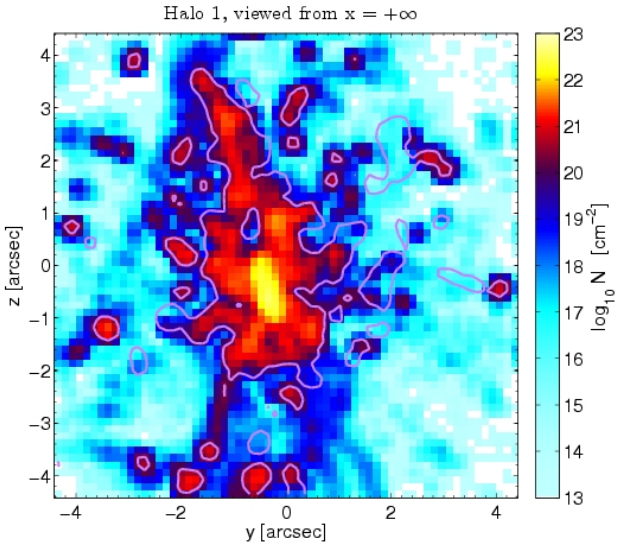
The differential incidence rate of DLAS



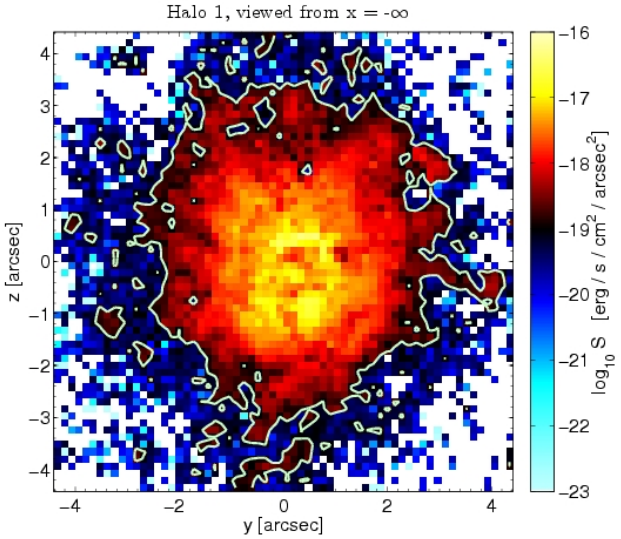
Barnes & Haehnelt 2008

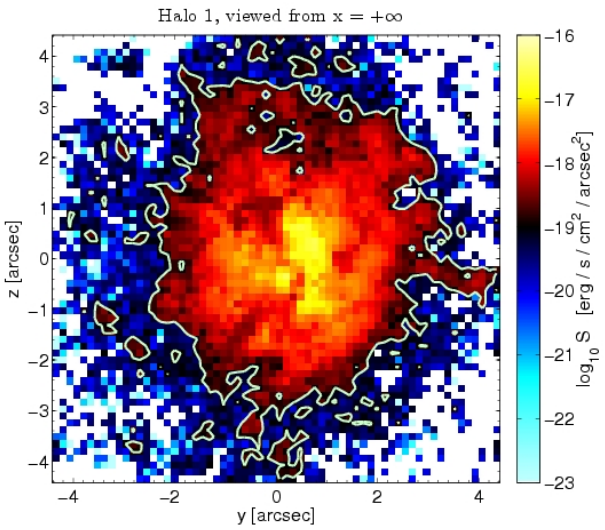
N_{HI}



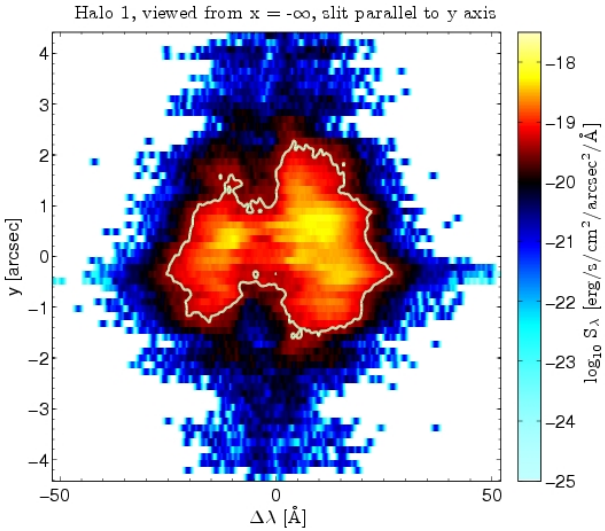


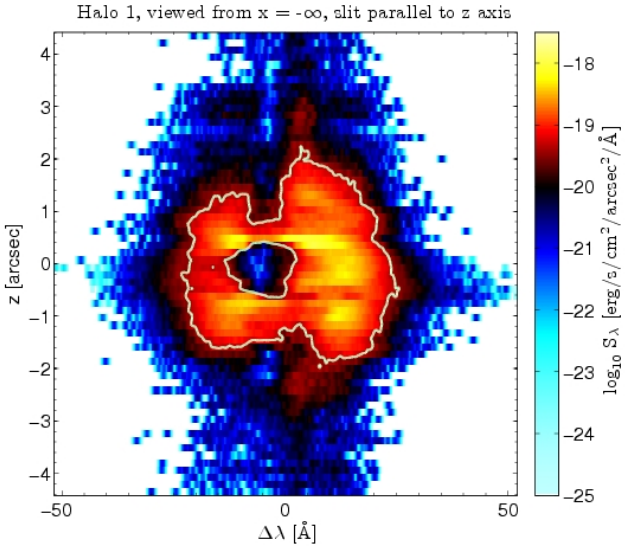
Lyα image





2D spectrum





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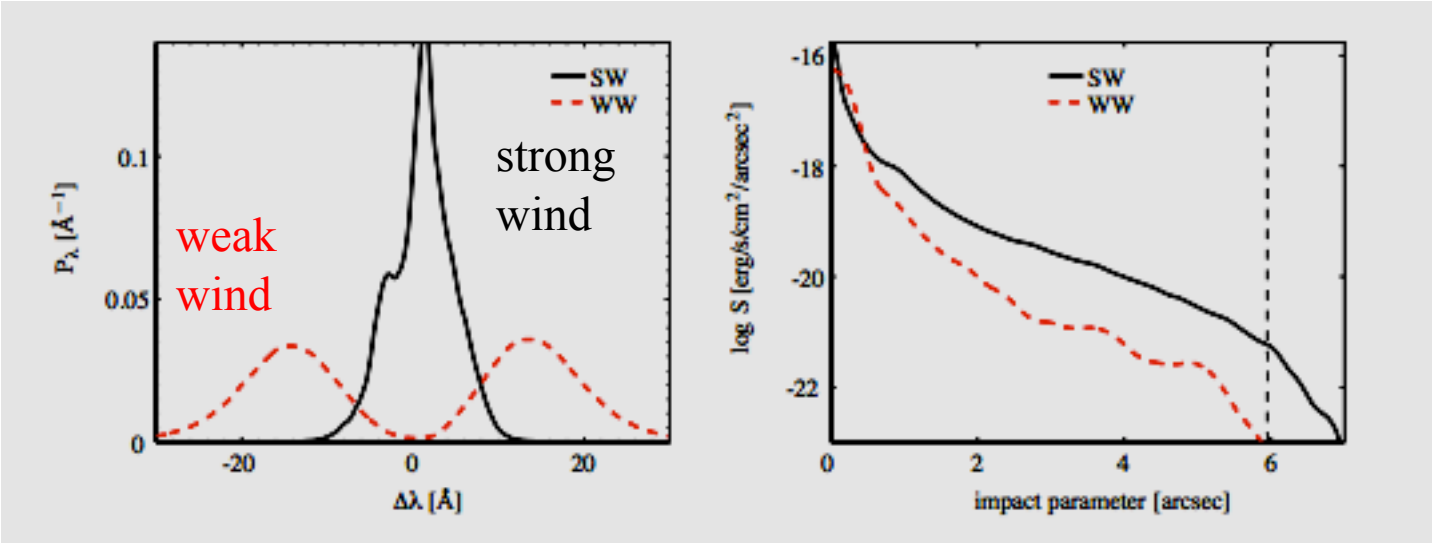
Barnes, PhD thesis

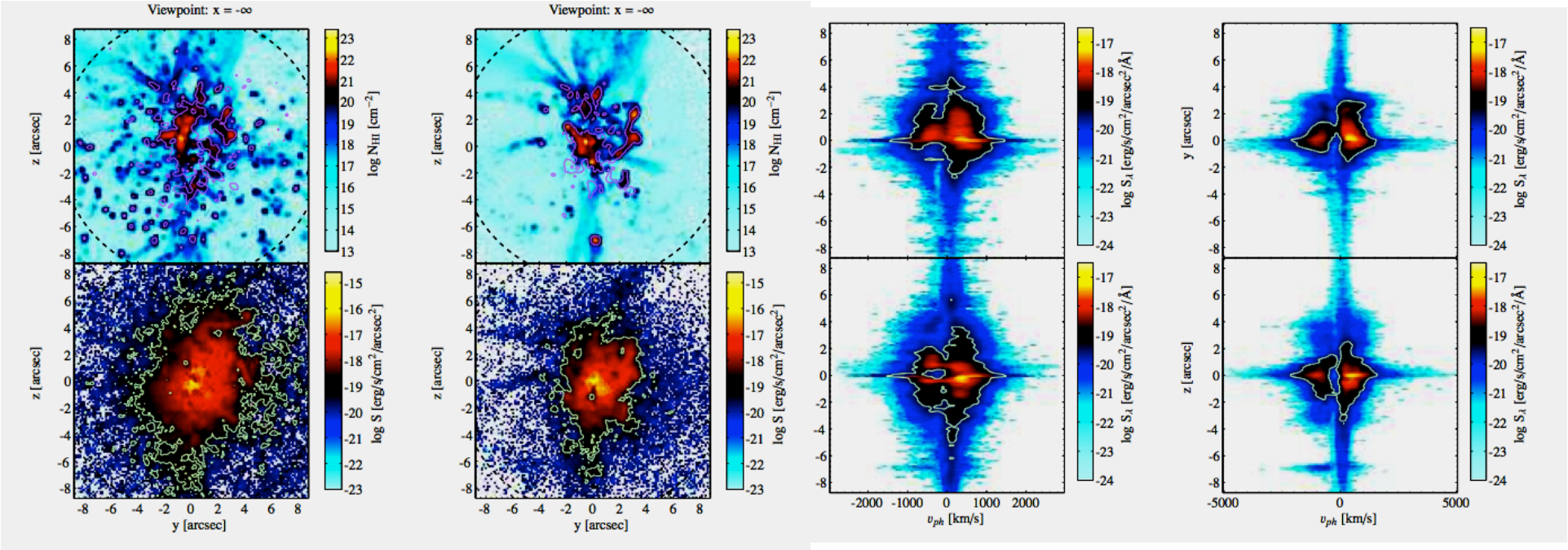
Probing outflows/inflows



Barnes et al. 2011

The Lyman-alpha emission depends strongly on the strength of a galactic wind.

strong winds weak winds strong winds weak winds



Barnes et al. 2011

IFU spectroscopy should become an excellent tool to discriminate between the rather crude implementations of galactic winds in numerical simulations.

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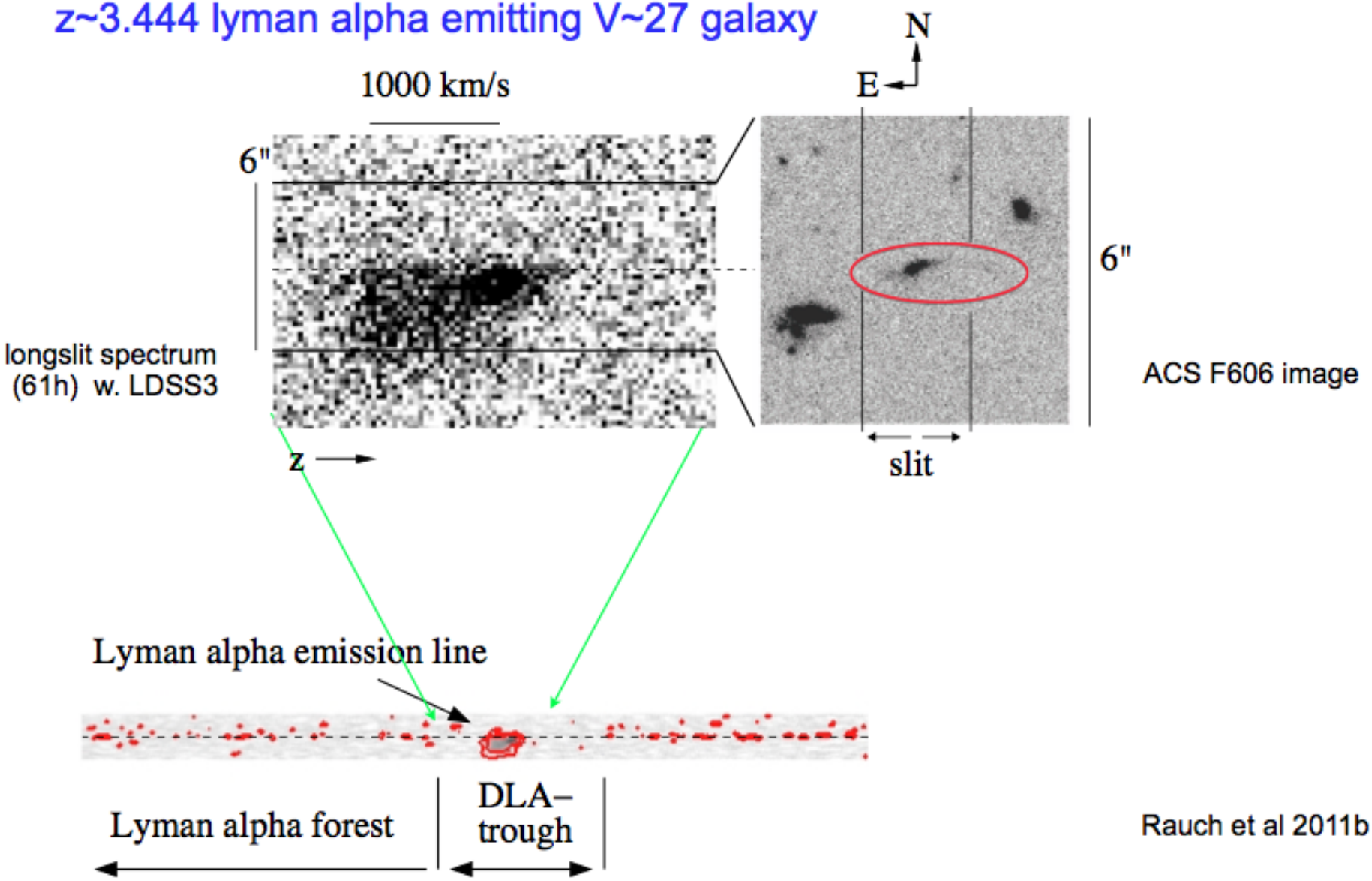
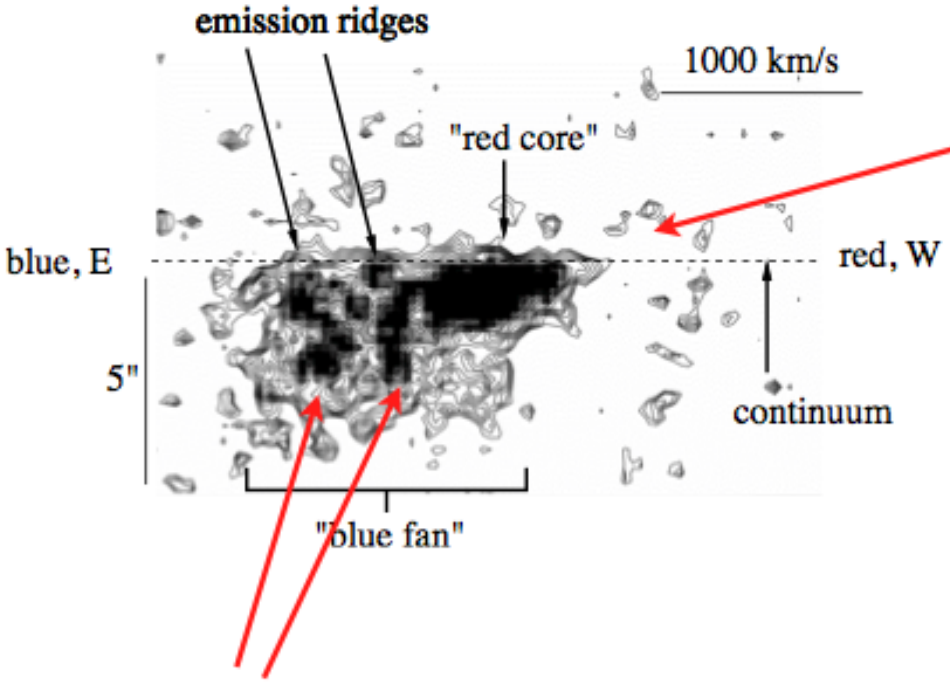
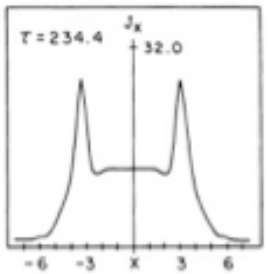
Breaking the spectral degeneracy between in and outflows



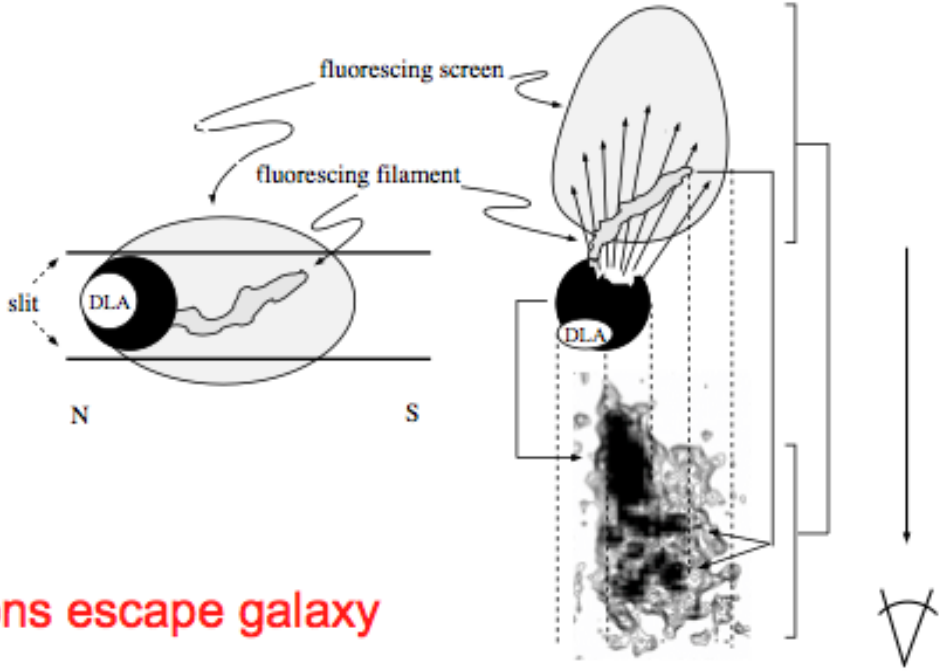


DLA sits in front of blueshifted, extragalactic gas --> Infall

infalling filament fluoresces in Lyalpha (double-humped profile!)



Urbaniak & Wolfe 81



~50 % of ionizing photons escape galaxy to hit blue infalling gas

Rauch et al. 2011

Summary

- very faint mostly spatially extended Lyα emitters detected at $2.67<z<3.75$ in 92h deep FORS2 and 40h Keck exposure
  - very steep faint end of Lyα luminosity function
  - inferred incidence rate corresponds to that of optically thick QSO absorption systems
  - probably host galaxy population of DLAS and LLS detected ($M_{tot}\sim 10^{10}$-10^{11} $M_{\odot}$, $V_{vir}\sim$ 50-150km/s); mainly powered by (spatially compact) star formation
  - building block of Milky-Way type galaxies
- Lyα most likely due to central star formation
- Lyα scatters in frequency and real space. Spatial extent and spectral shape is very sensitive to details of the kinematics of the gas.