

Simulating the cosmic distribution of gas (HI & metals) and its connection with galaxies

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Evolution & Assembly of GaLaxies & their Environments

Schaye+15

$z = 9.2$
 $t = 0.5 \text{ Gyr}$
 $L = 25.0 \text{ cMpc}$

Visualisation by
Jim Geach & Rob Crain

Ionization Processes

✿ Gravity + hydrodynamics, e.g. self-shielding correction (significantly modified)

✿ Star formation

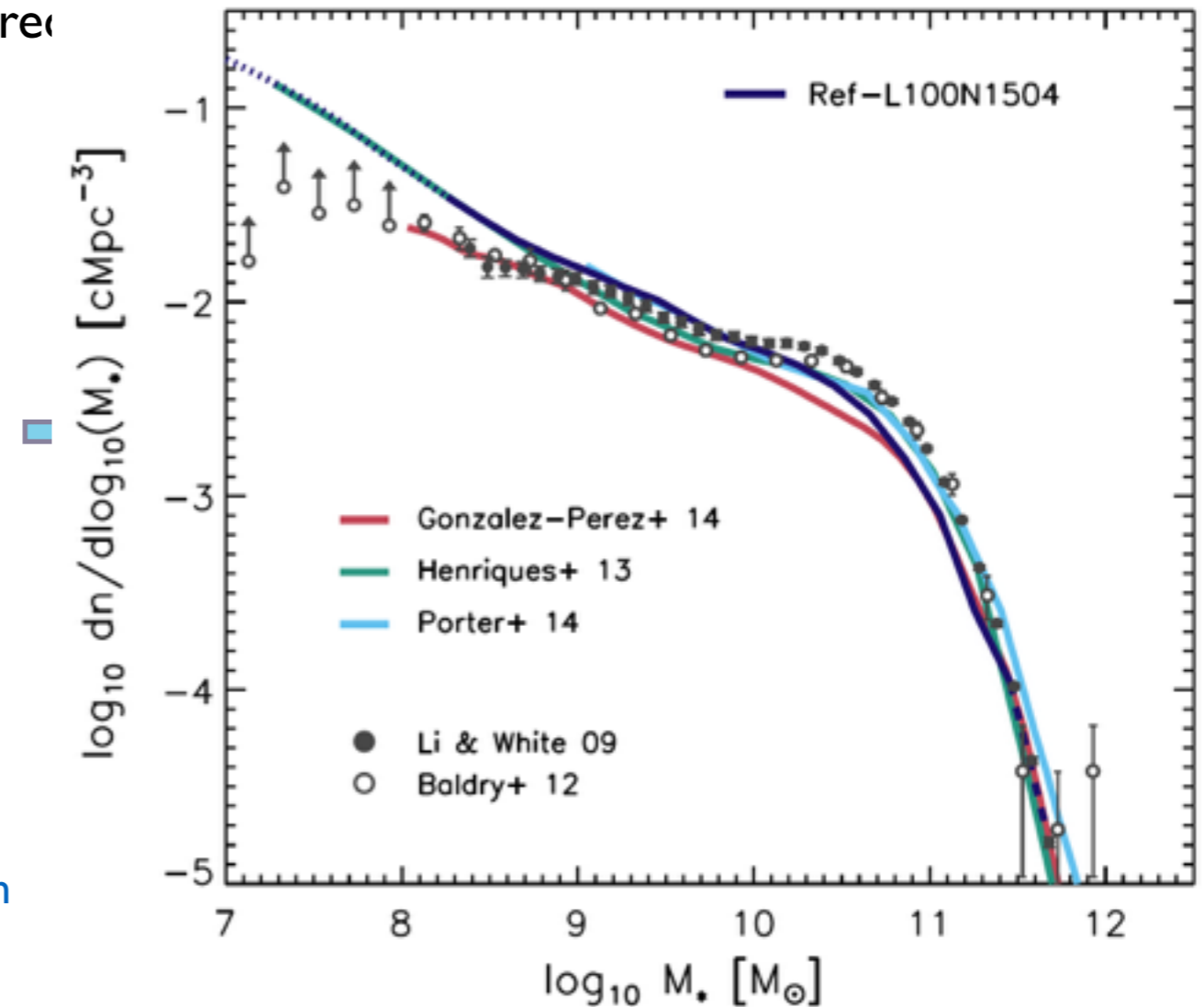
✿ Supernovae & AGN feedback

✿ Rad. Heating/cooling with metals

✿ Planck cosmology

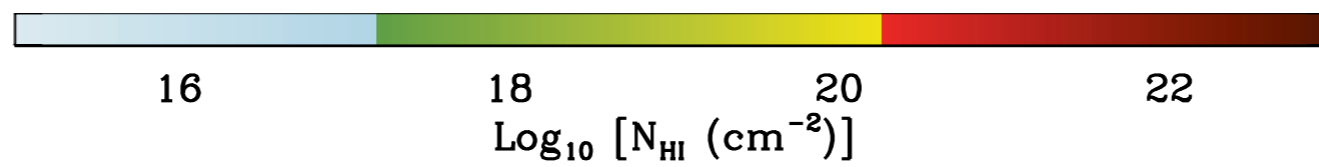
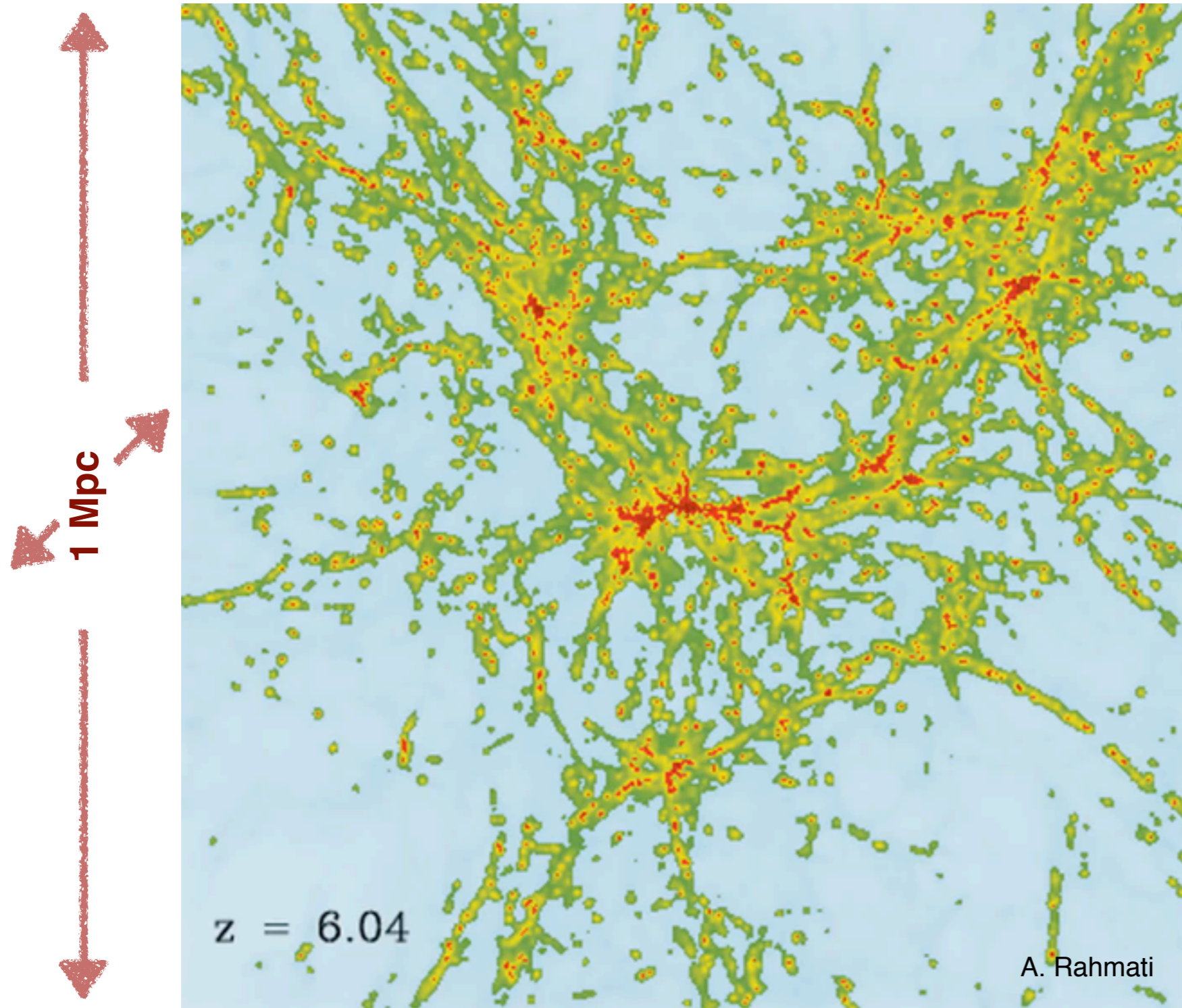
✿ $L = 25\text{-}100 \text{ Mpc}$; $M_g = 10^5\text{-}10^6 M_{\text{sun}}$

e.g., Romeel's & Dusan's talks

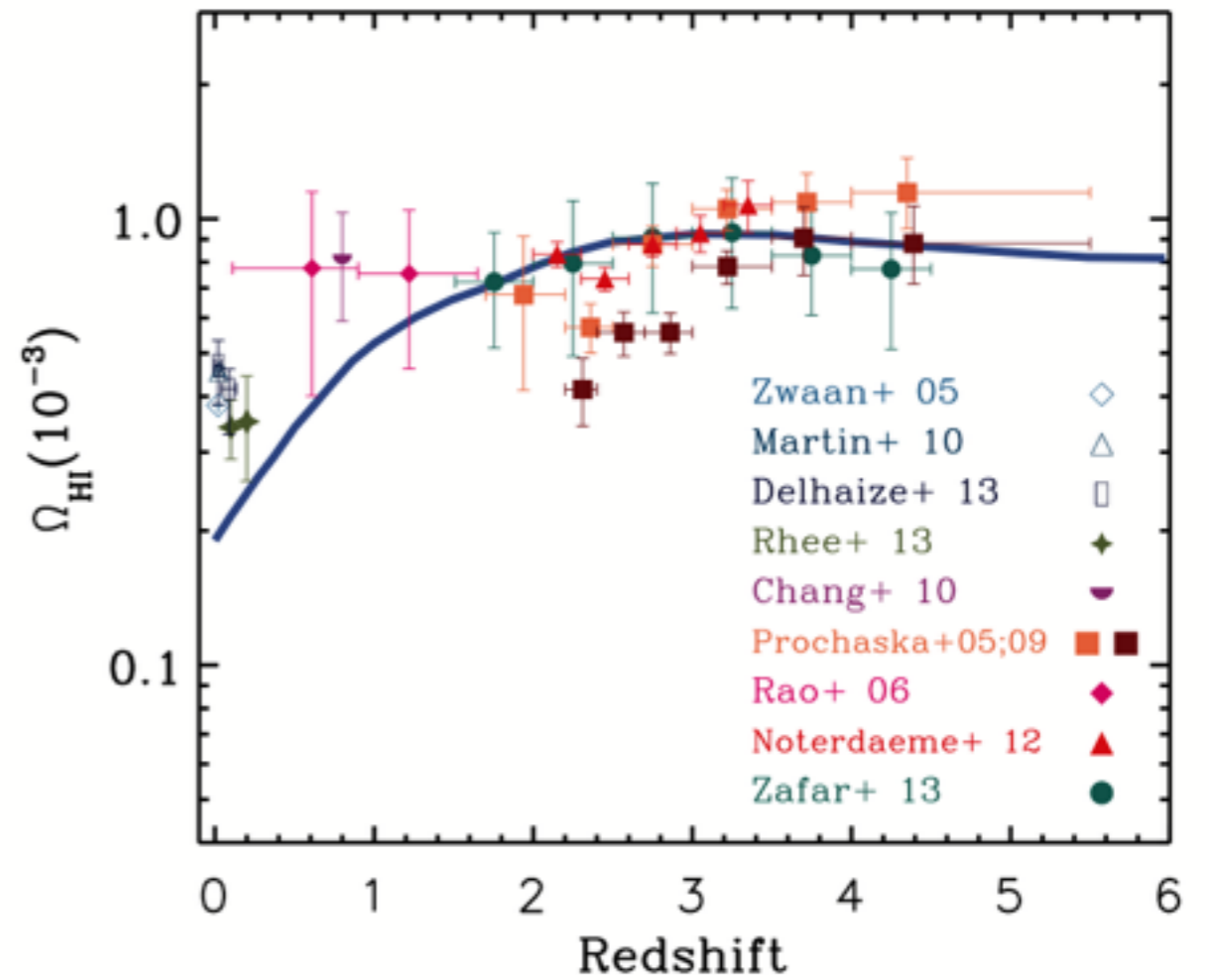
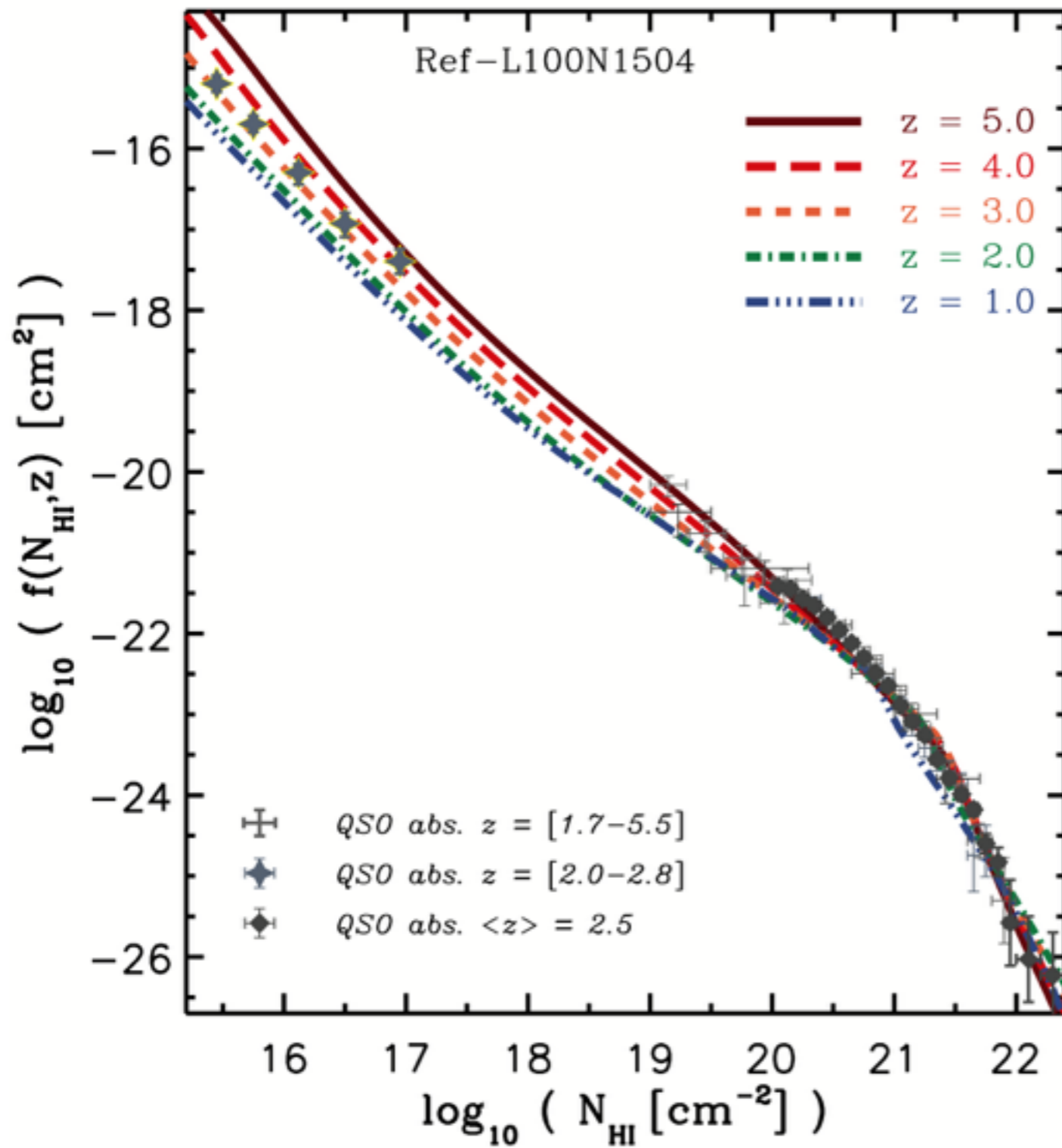


Schaye+15; Furlong+14

HI distribution



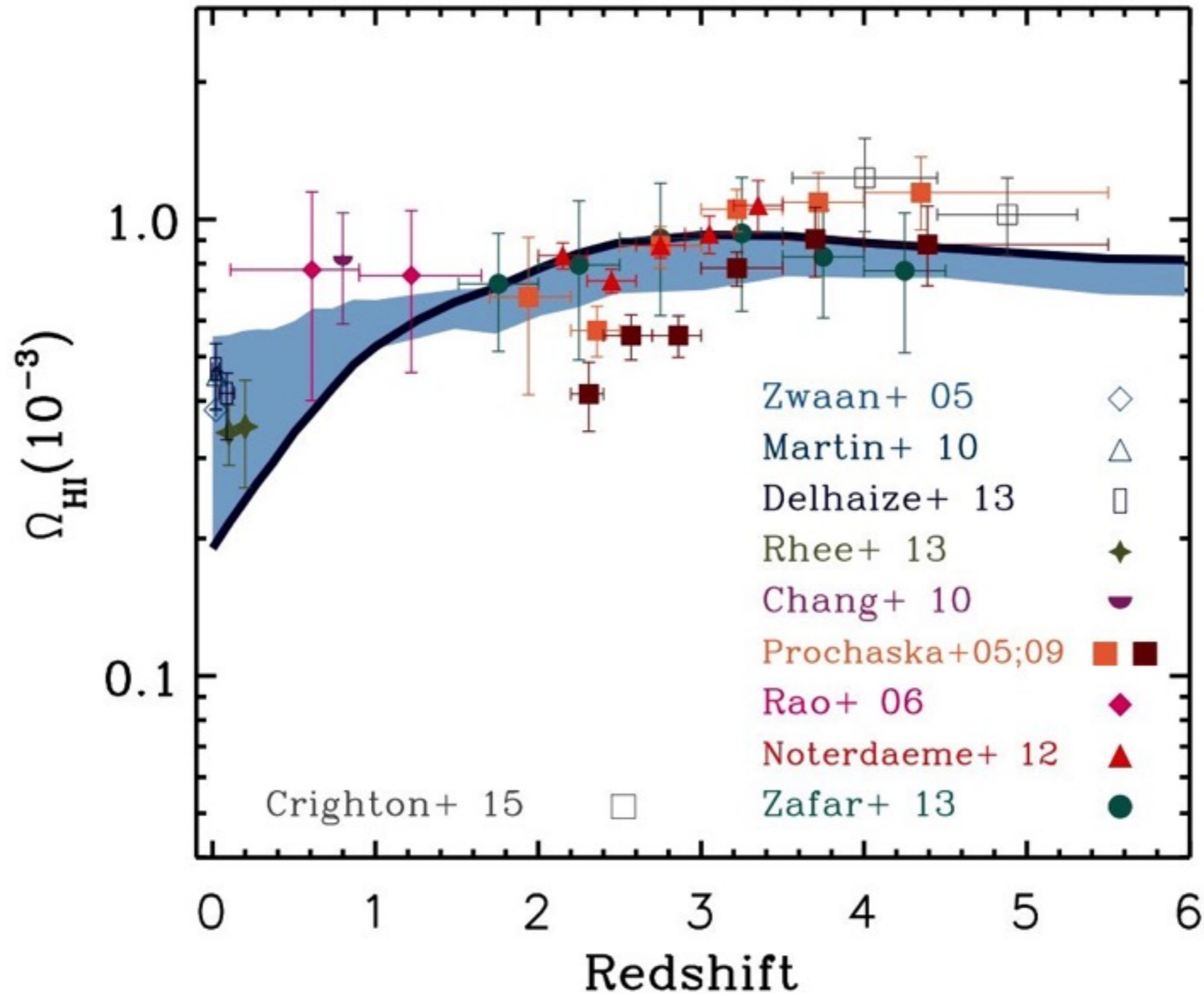
Cosmic distribution of HI



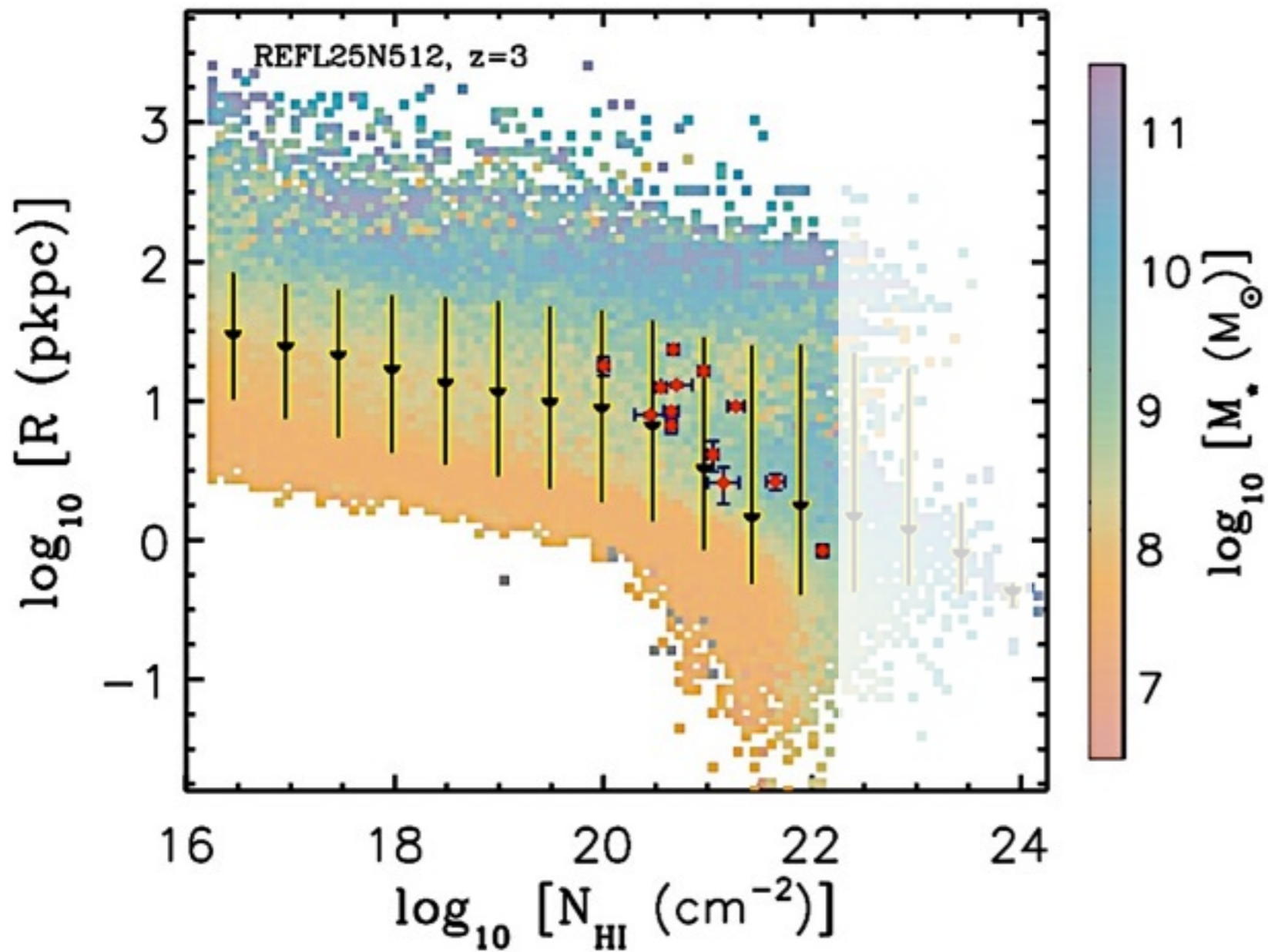
Rahmati+15; Rahmati+13a

Celine's & Neil's talks

Cosmic distribution of HI



Connection between HI absorbers and galaxies



Higher $N[\text{HI}]$ systems are closer to their host galaxies

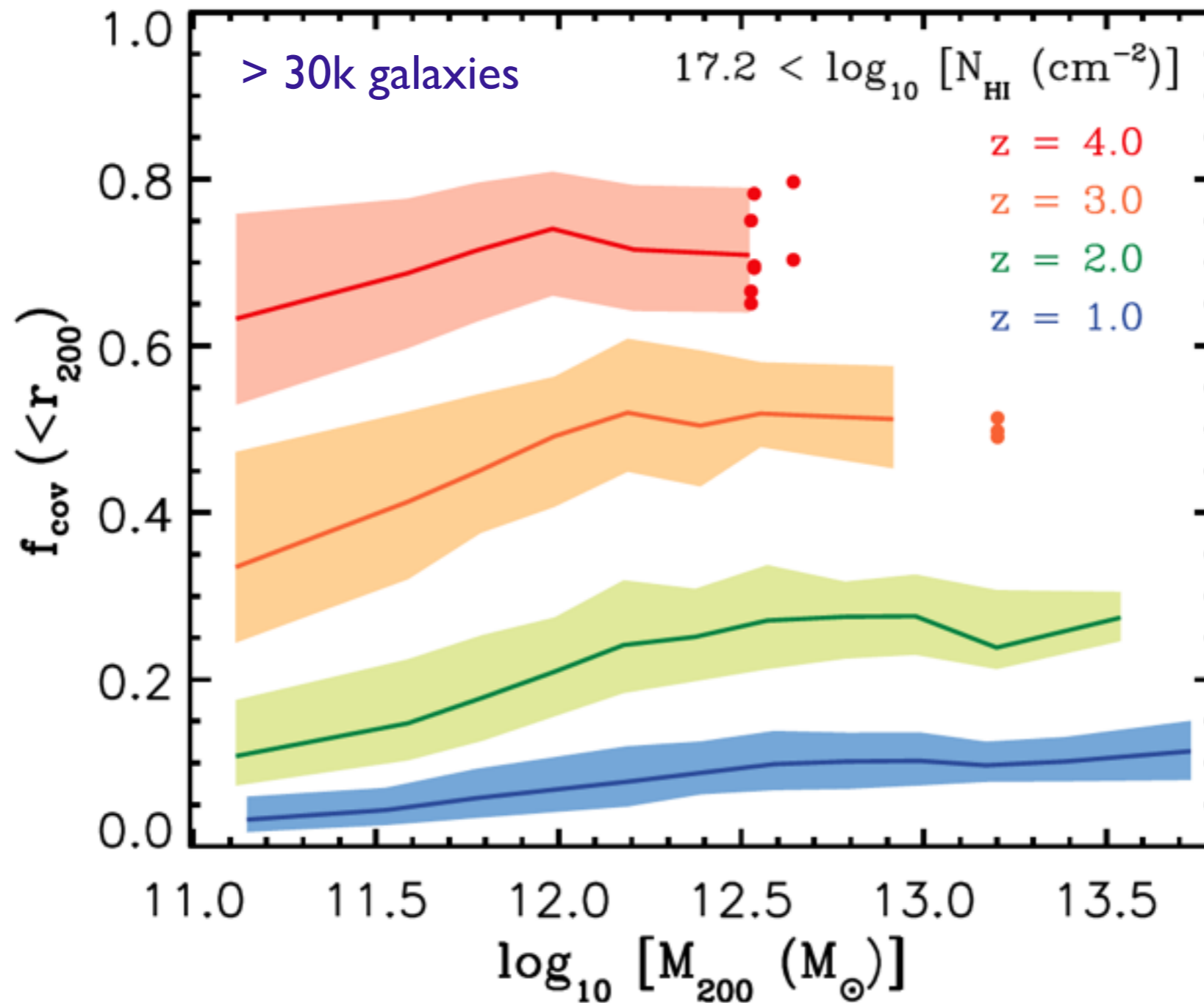
There is a large scatter in the impact parameters

Most HI absorbers are close to low mass galaxies

(in good agreement with observations)

Celine's, Marc's & Michele's talks

Predicted covering fraction of HI (LLSs) around galaxies



Rahmati+15

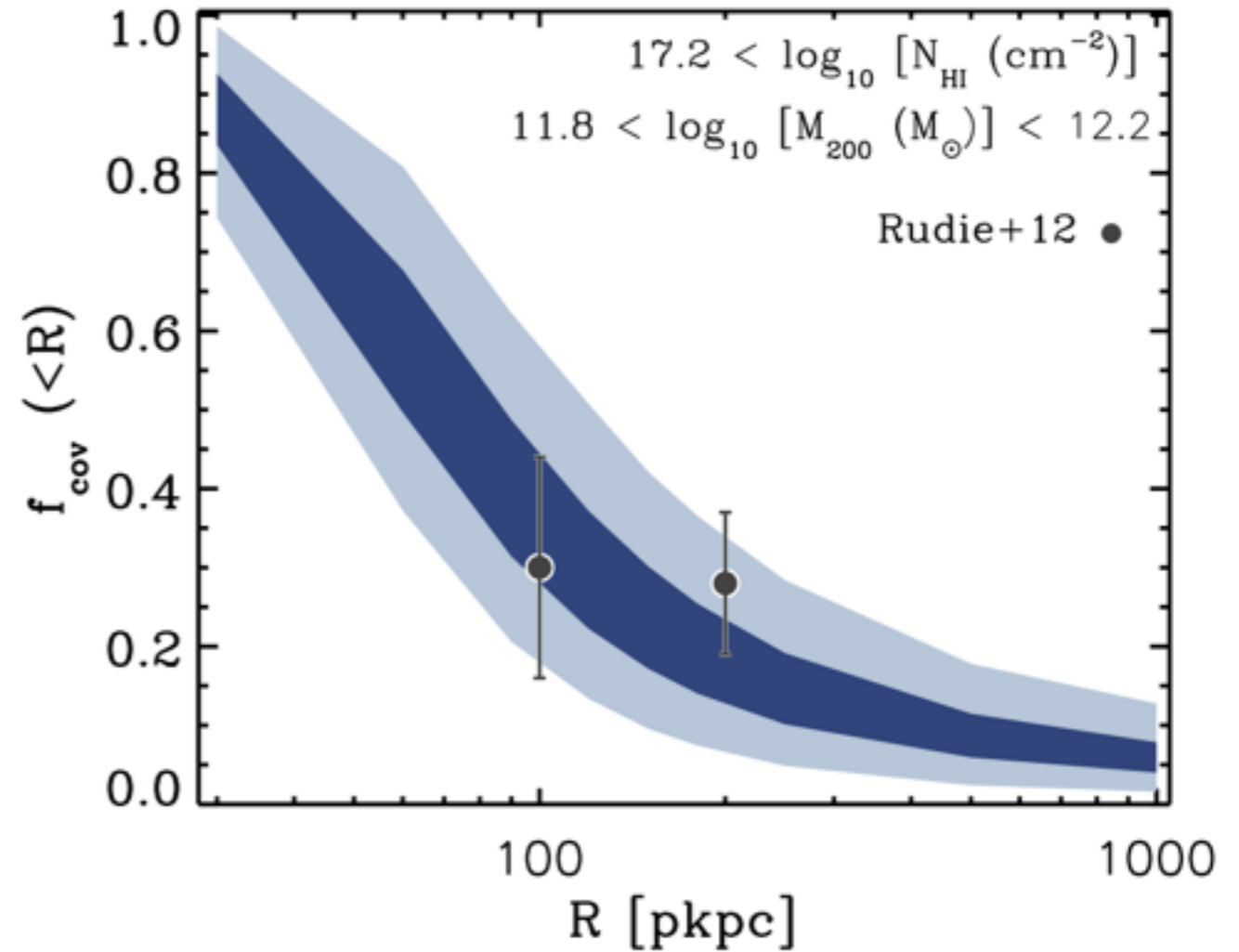
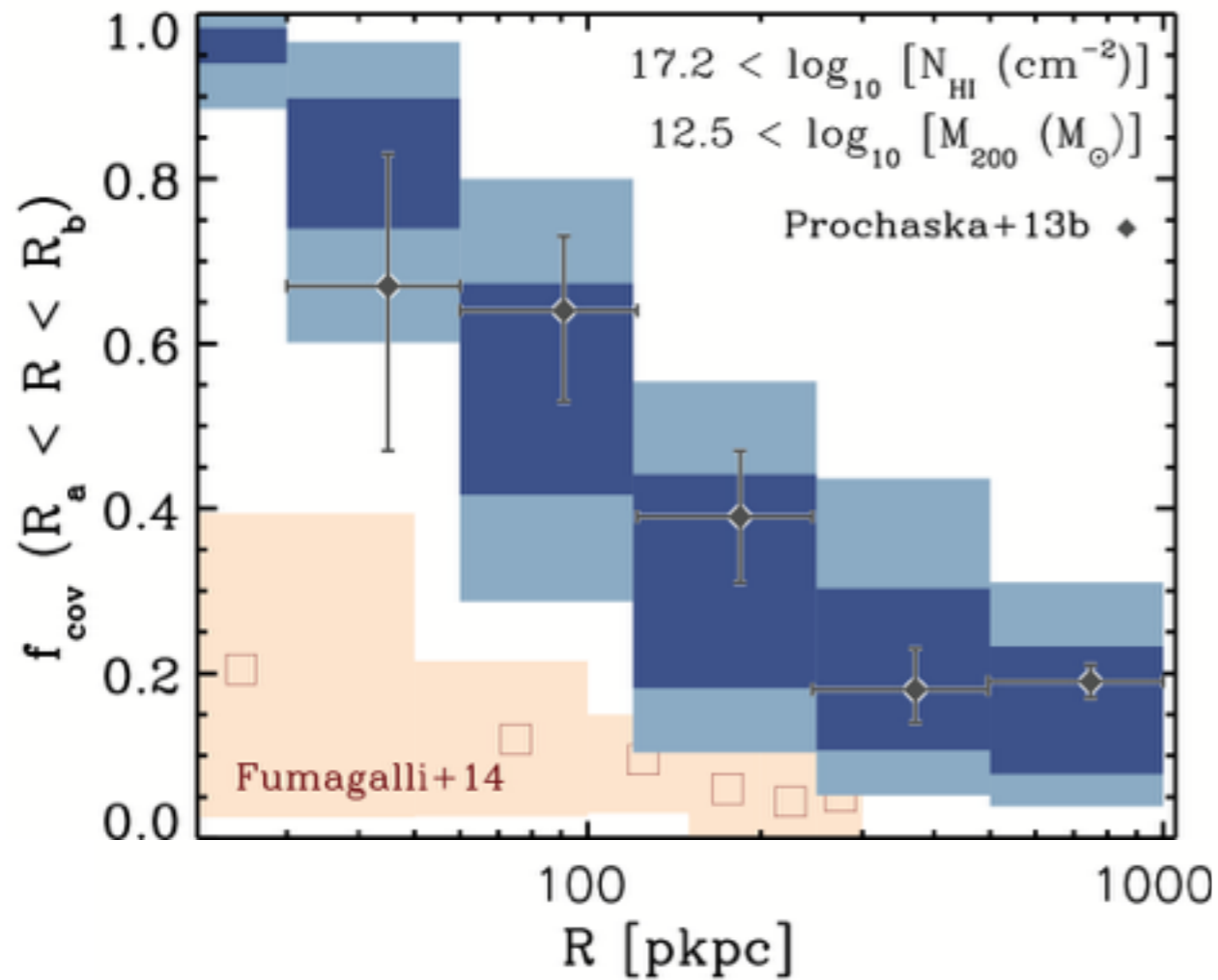
see also Faucher-Giguere+15 for the evolution
but mind the difference at high masses

HI covering fraction around bright QSOs & LBGs

two bracketing models:

I- $z = 2.2$ + Haardt & Madau 01 UVB model

II- $z = 3.0$ (2.5 for LBGs) + Haardt & Madau 12 UVB model

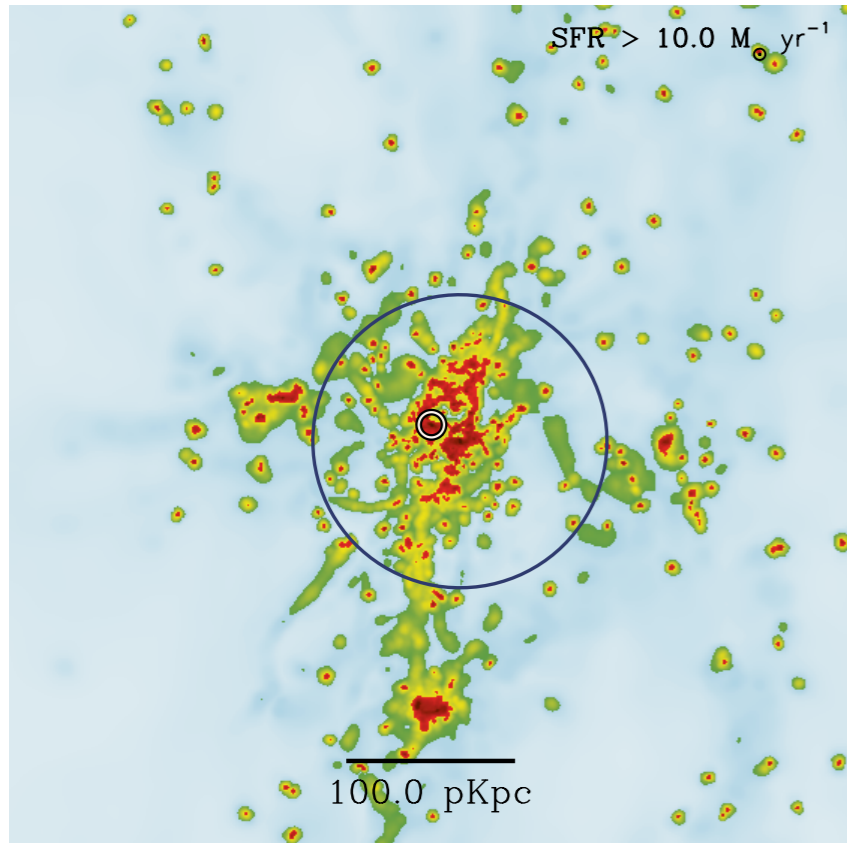


Rahmati+15

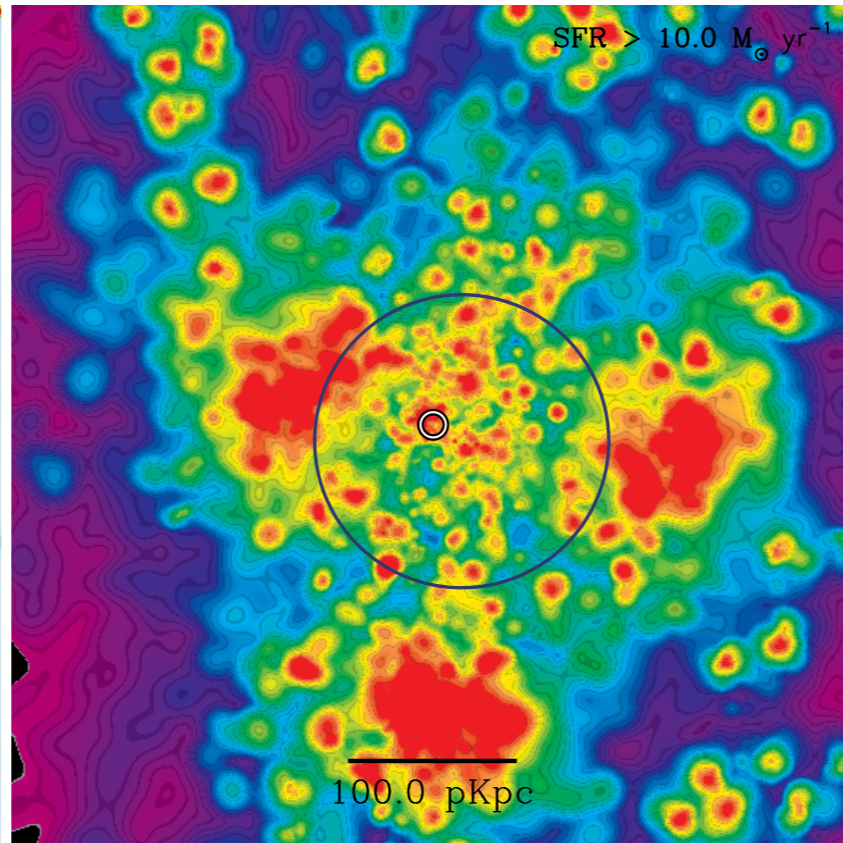
Sebastian's, Claude-Andre's & Michele's talks

Metals? constraining feedback?

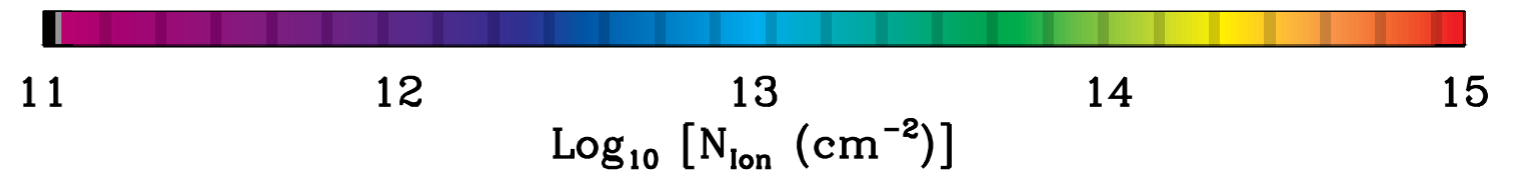
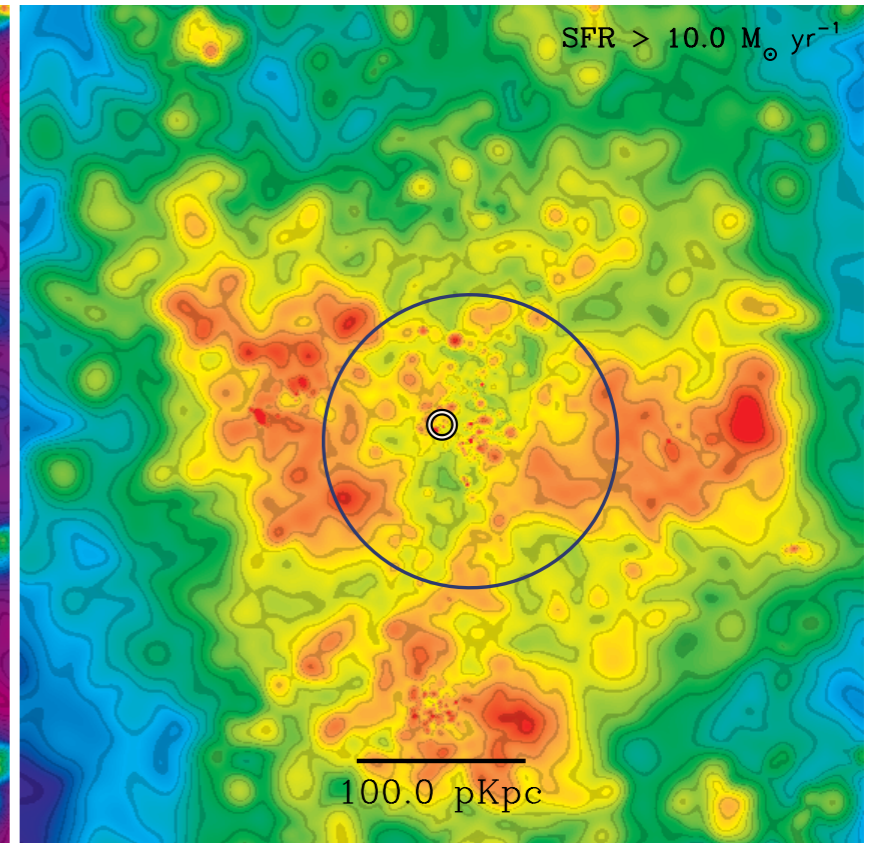
HI



CIV

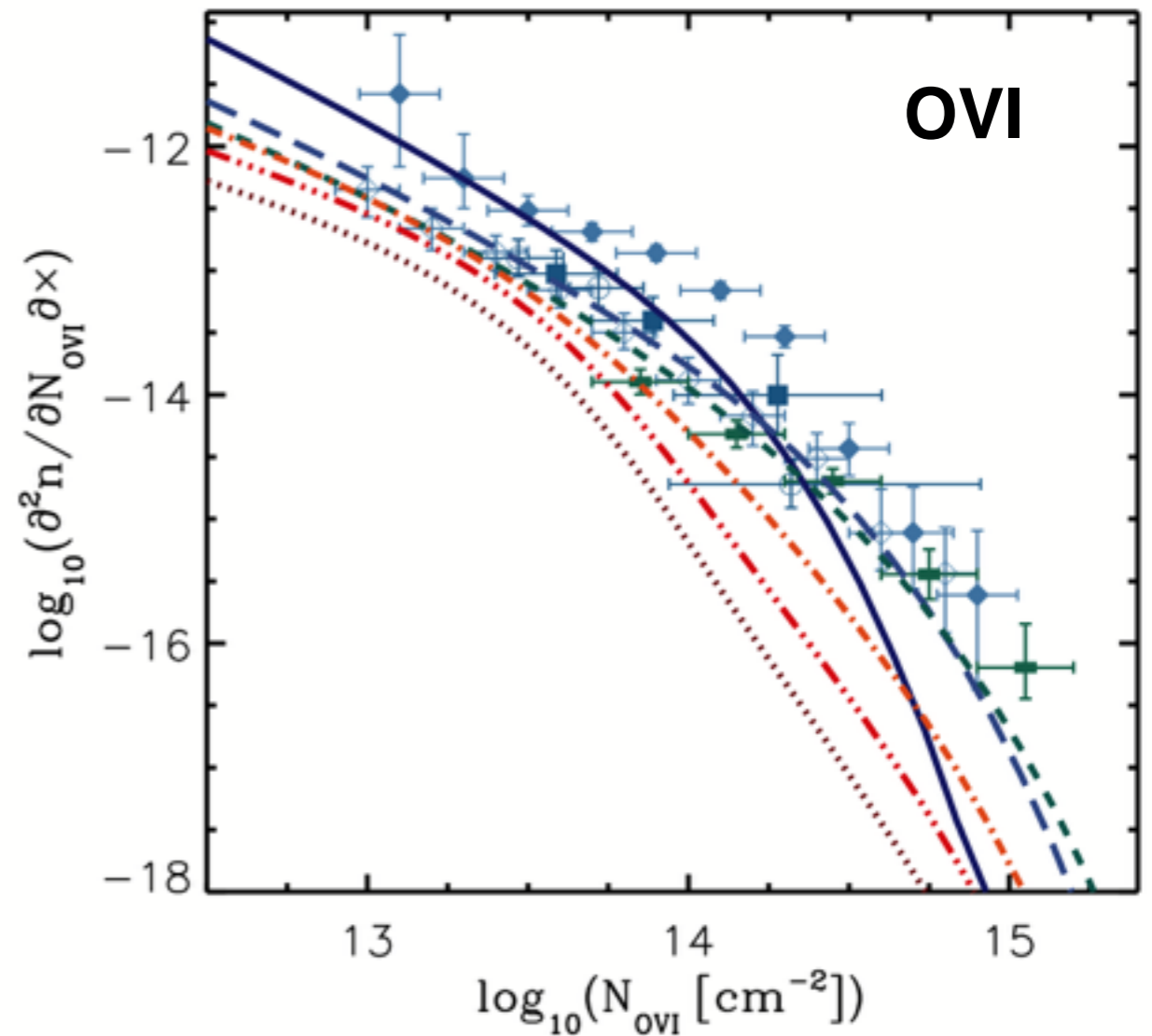
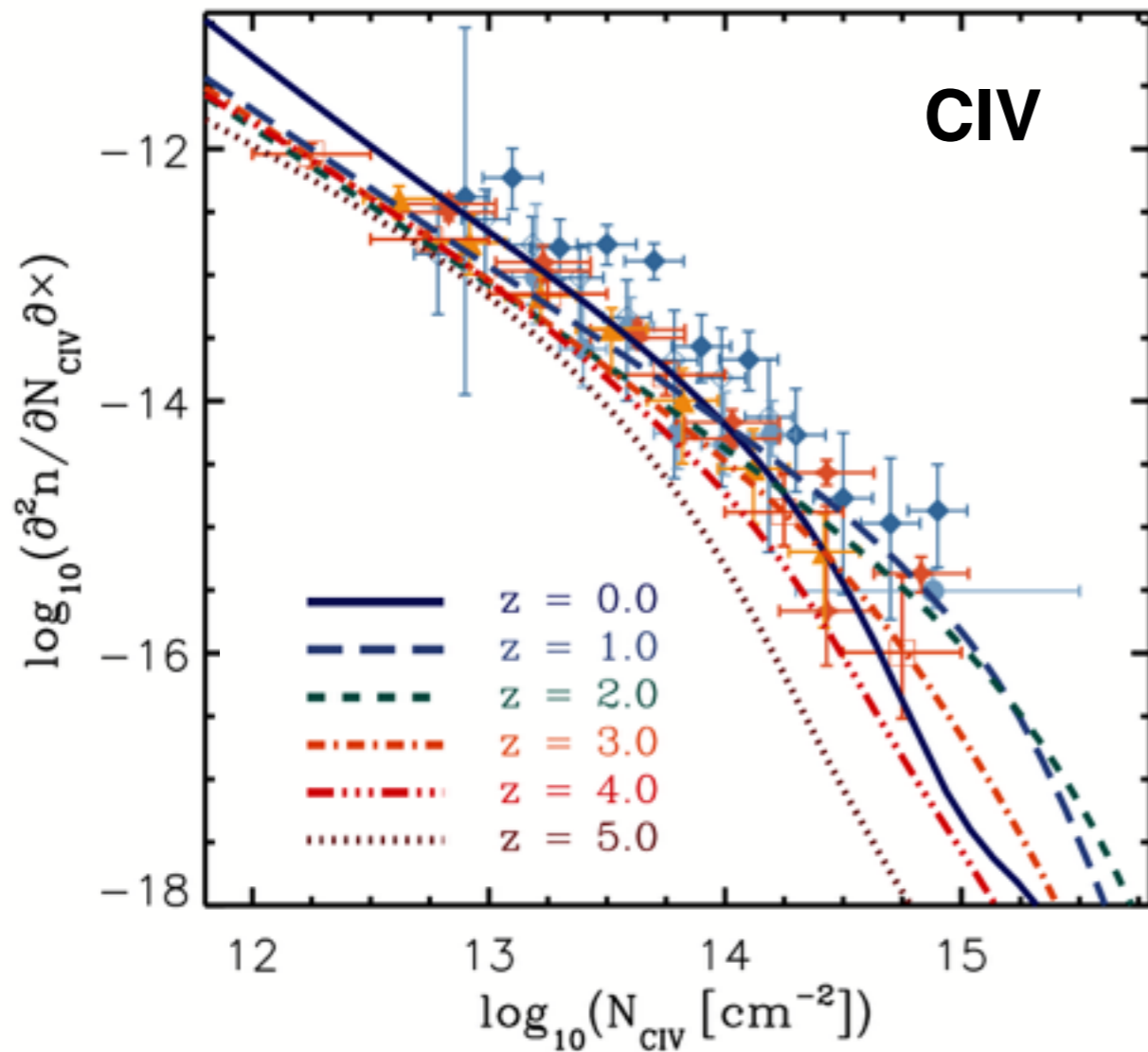


OVI



Kate's & Jessica's talks

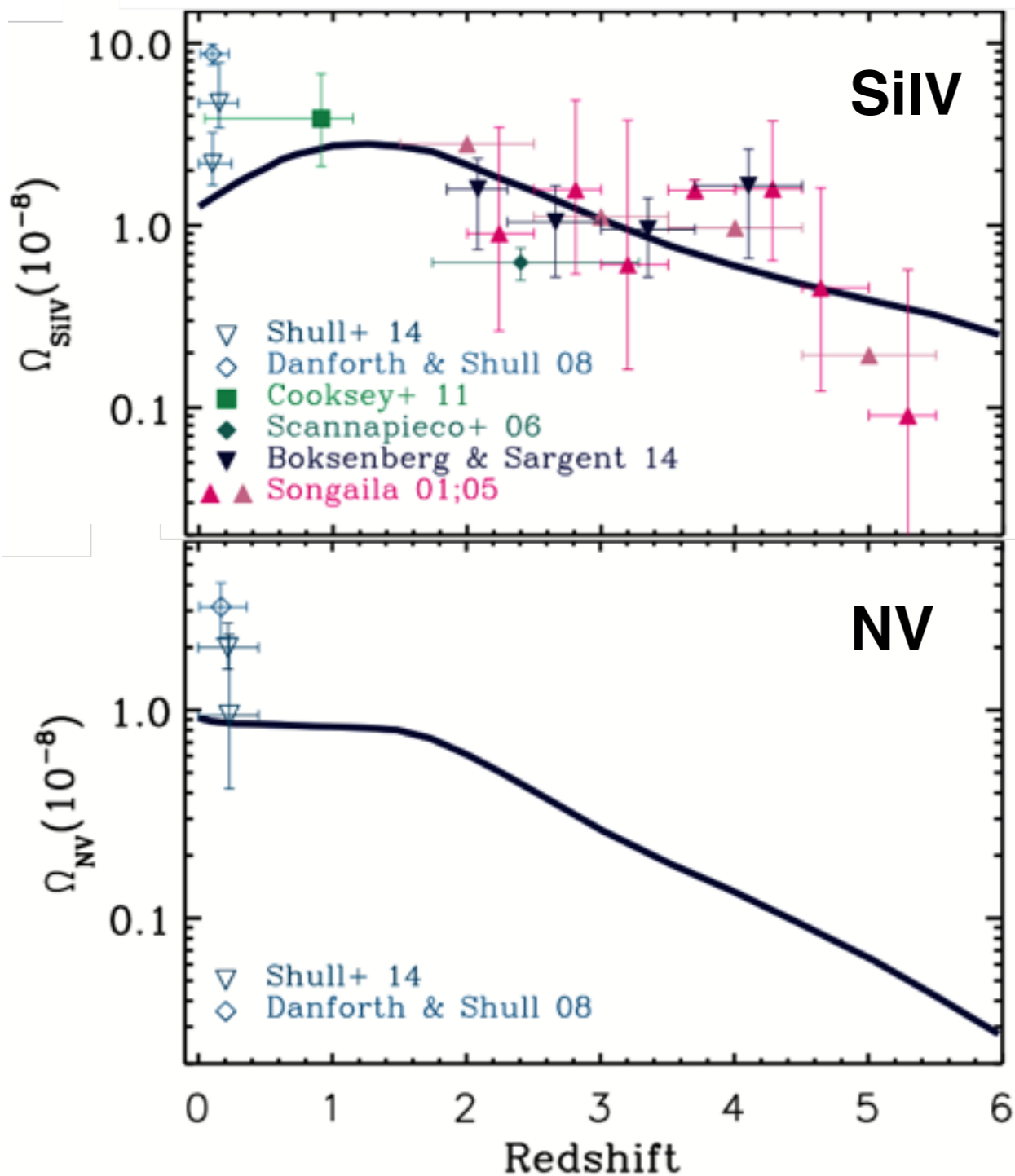
Cosmic distribution of high ionization metals



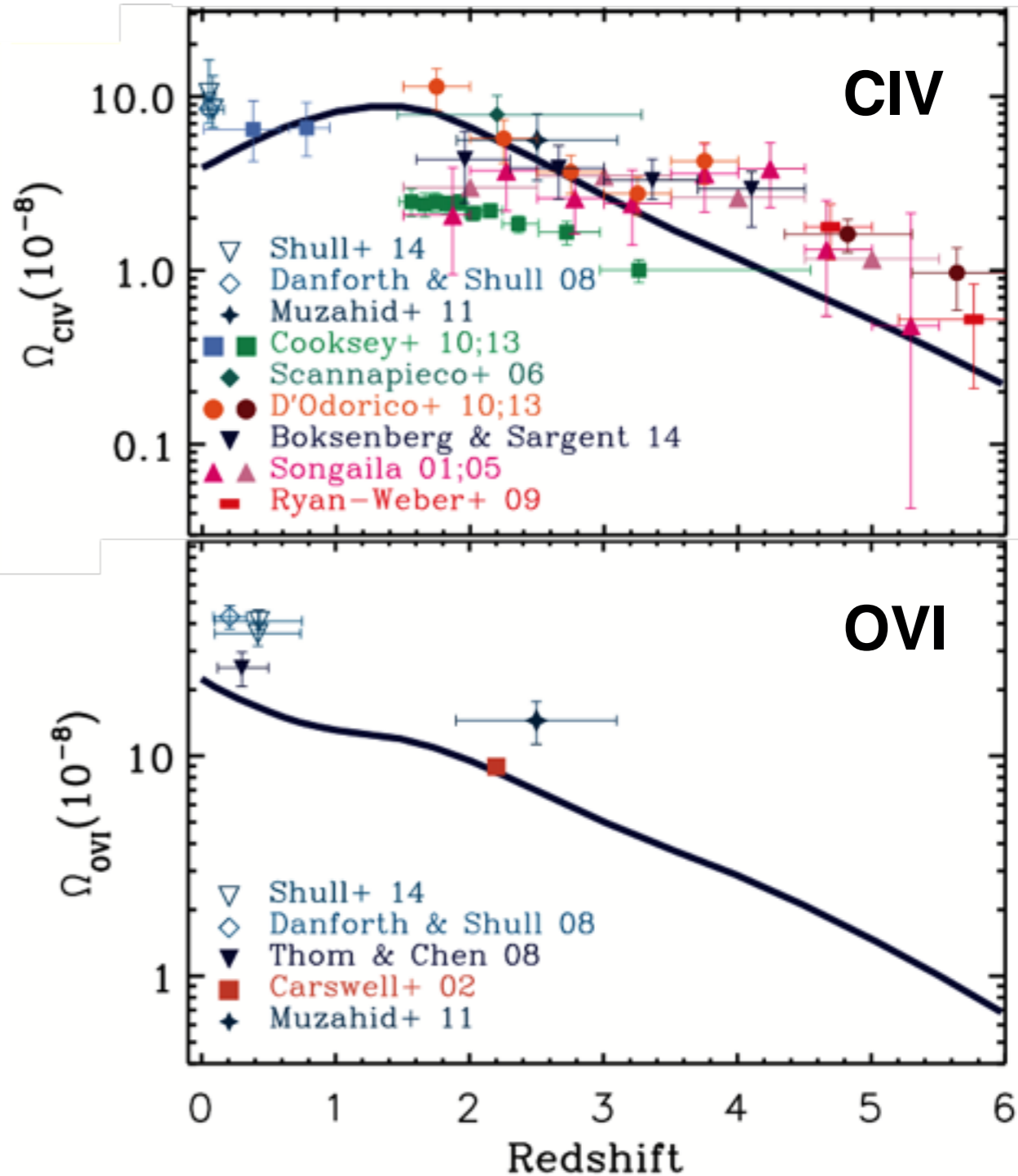
Rahmati+ in prep
(see also Schaye+15 for low-z)

Valentina's talk

Cosmic distribution of high ionization metals

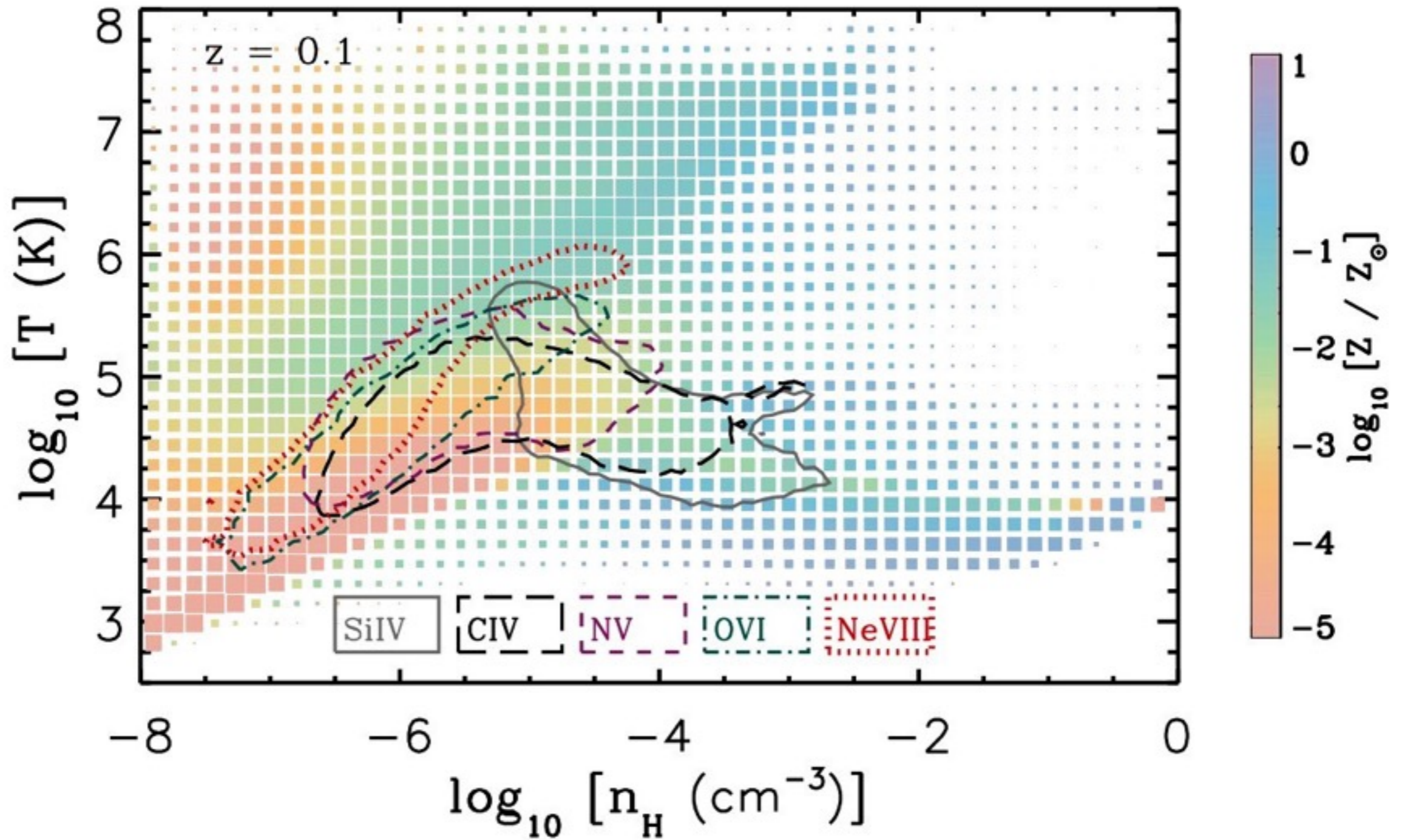


Rahmati+ in prep



Valentina's talk

Physical properties of high ionization metals



Rahmati+ in prep

Jessica's talk

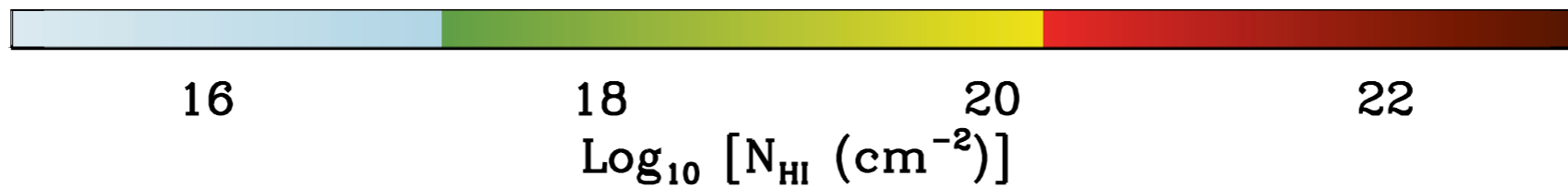
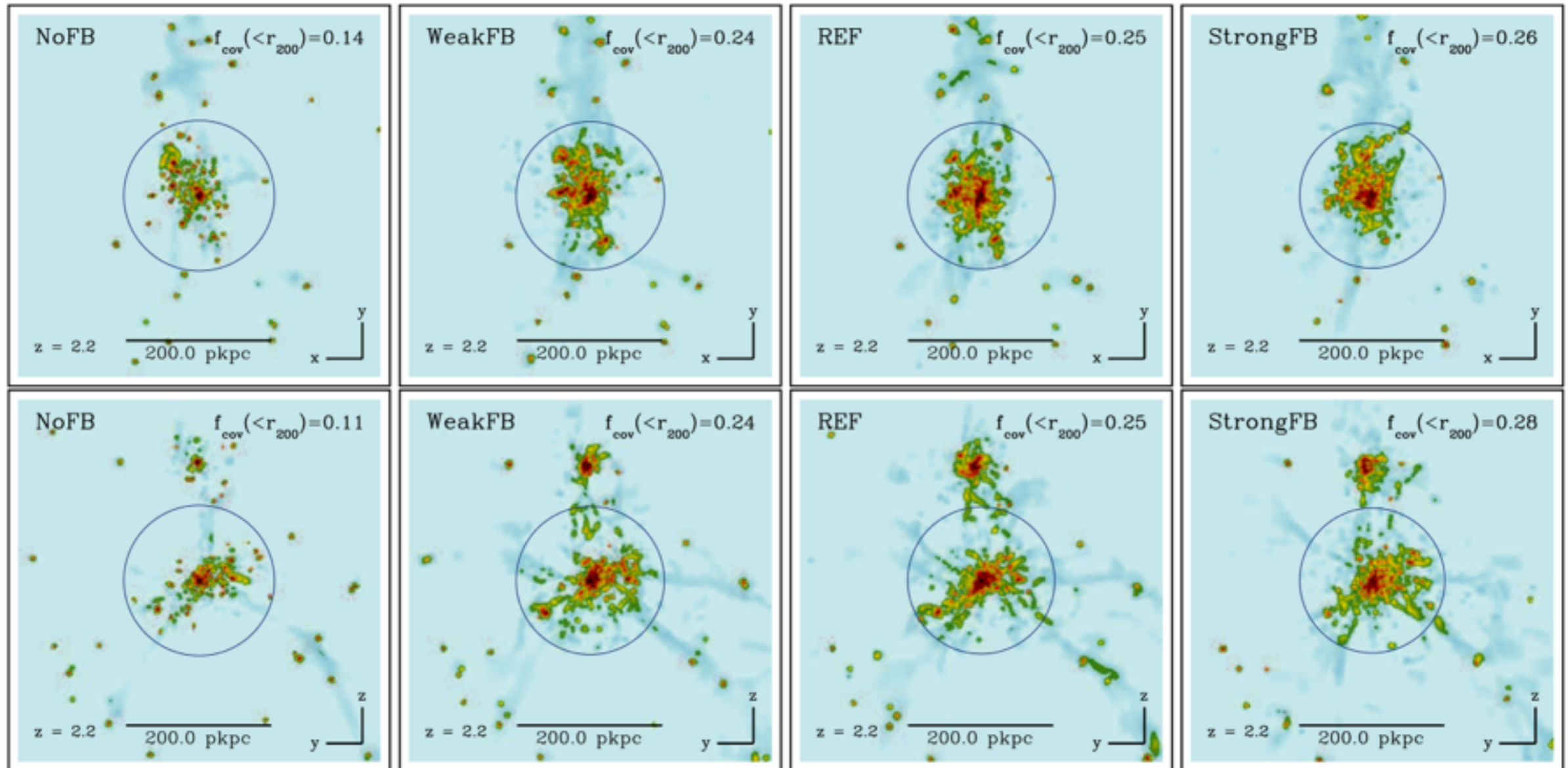
The importance of efficient feedback: HI

No Feedback

1/2x SF

Reference

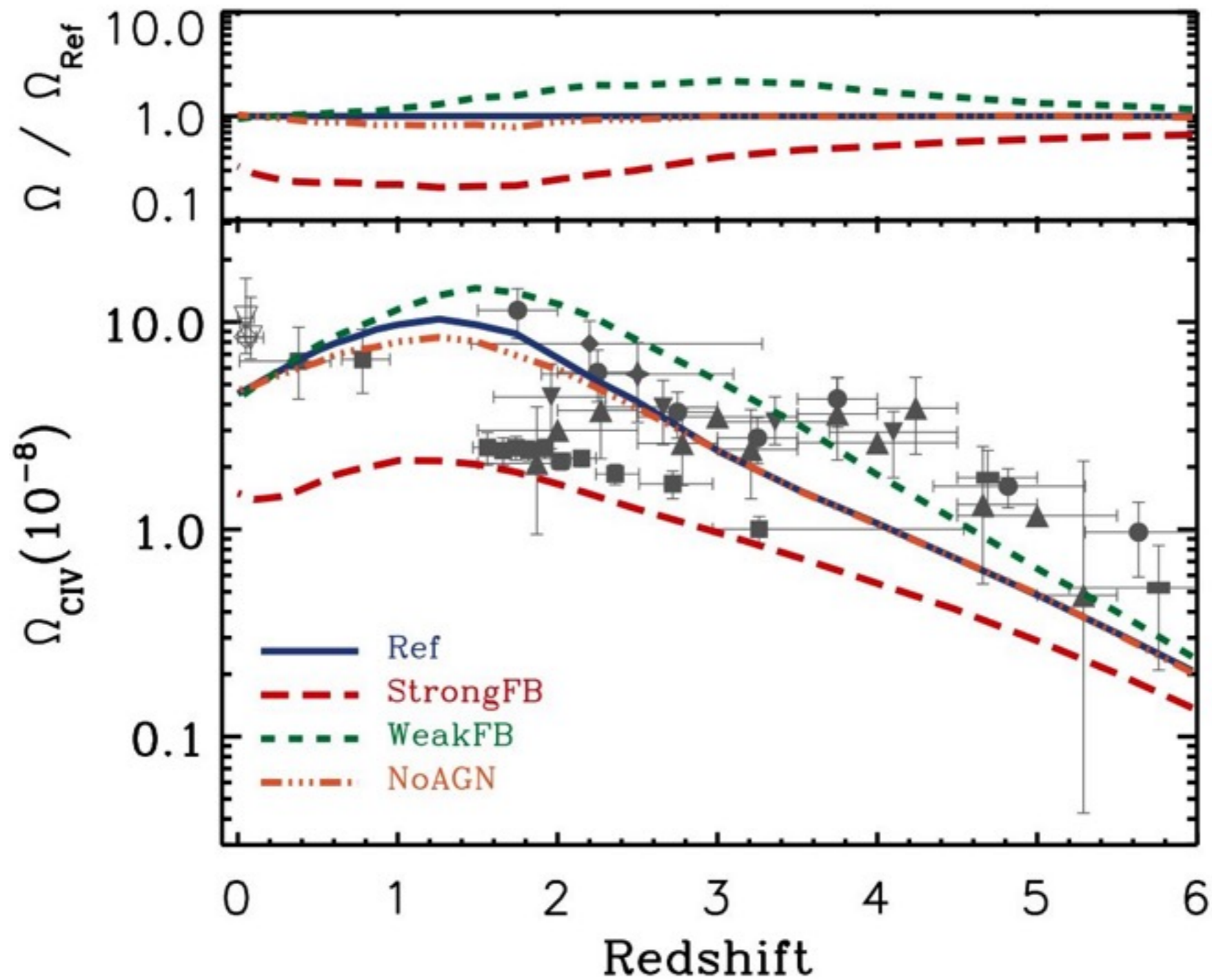
2x SF



Rahmati+15

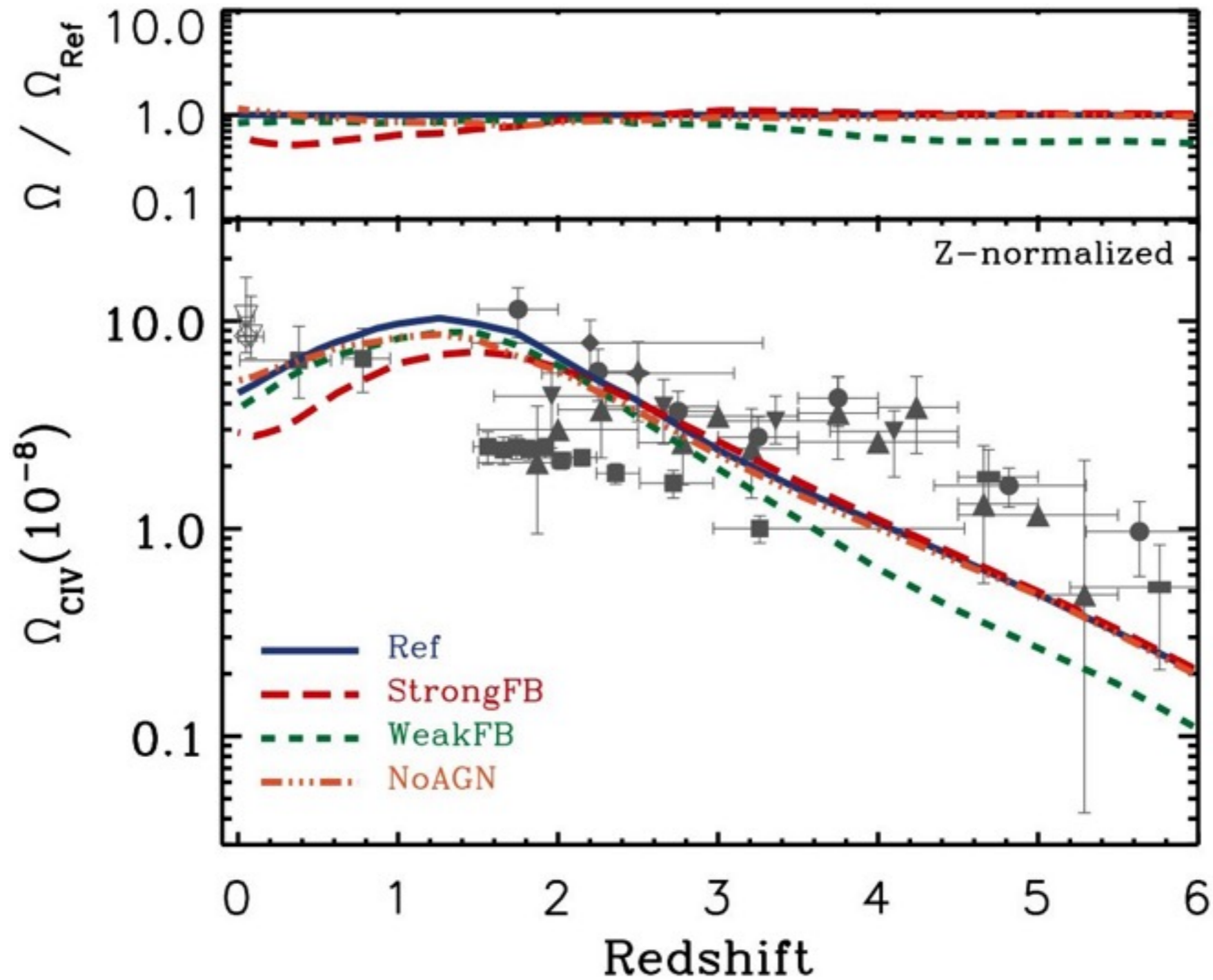
Sebastian's & Claude-Andre's talks

The importance of efficient feedback: metals



Rahmati+ in prep

The importance of efficient feedback: metals



Summary and Conclusions

- ❖ EAGLE reproduces the cosmic distribution of HI and metal absorbers and the observed HI covering fractions around LBGs and QSOs at $z \sim 2-3$
- ❖ Most strong HI and metal absorbers are associated with tiny galaxies
- ❖ Predicted HI properties are weakly sensitive to model properties (at least in EAGLE simulations) once the feedback is relatively efficient (compared to no or negligible feedback)
- ❖ Distribution of metals is more sensitive to feedback variations compared to HI
- ❖ This dependency is largely related to the sensitivity of star formation rates to feedback: the cosmic distribution of metals may not necessary provide us with addition constraints on feedback!