# The ULAS J1120+0641 sightline: intervening metal absorption up to z = 7

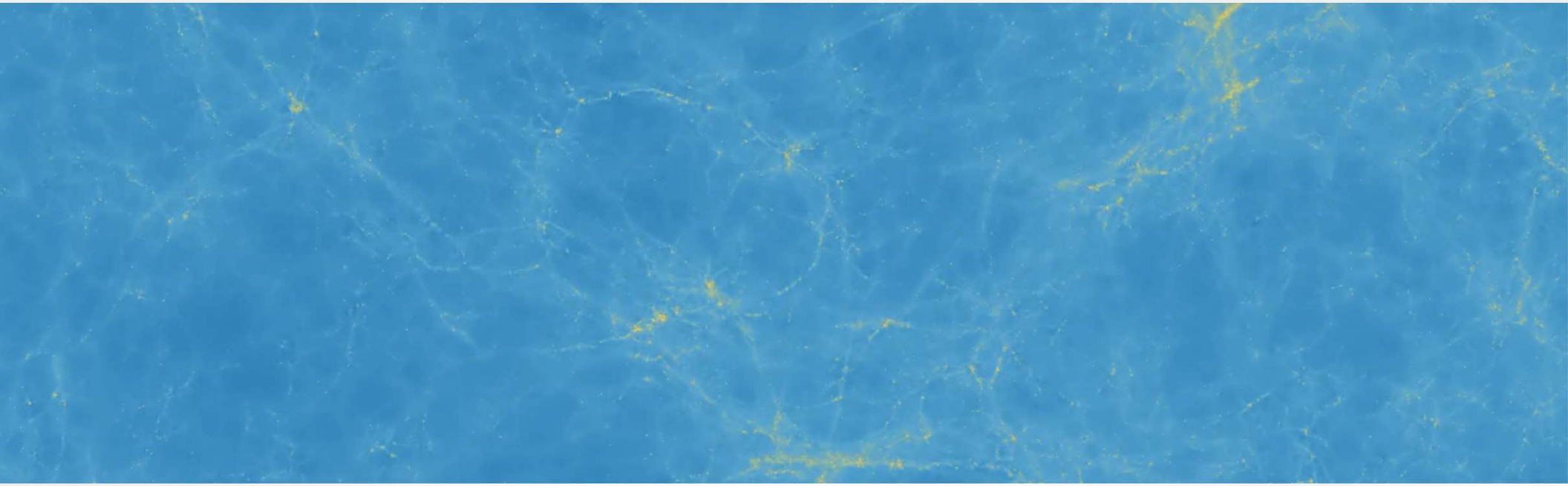
Sarah Bosman
University of Cambridge

PhD supervisors: Martin Haehnelt and George Becker

Collaborators: Paul Hewett, Richard McMahon, Daniel Mortlock, Chris Simpson, Bram Venemans



# Measuring Metal Enrichment of the CGM using Absorption



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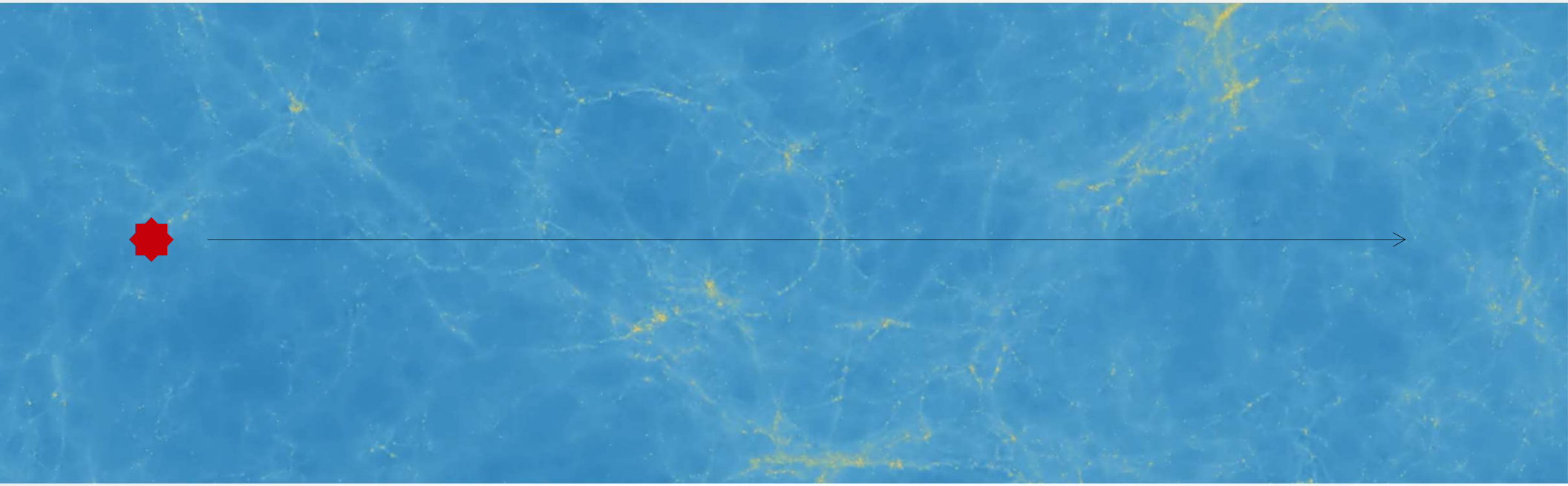

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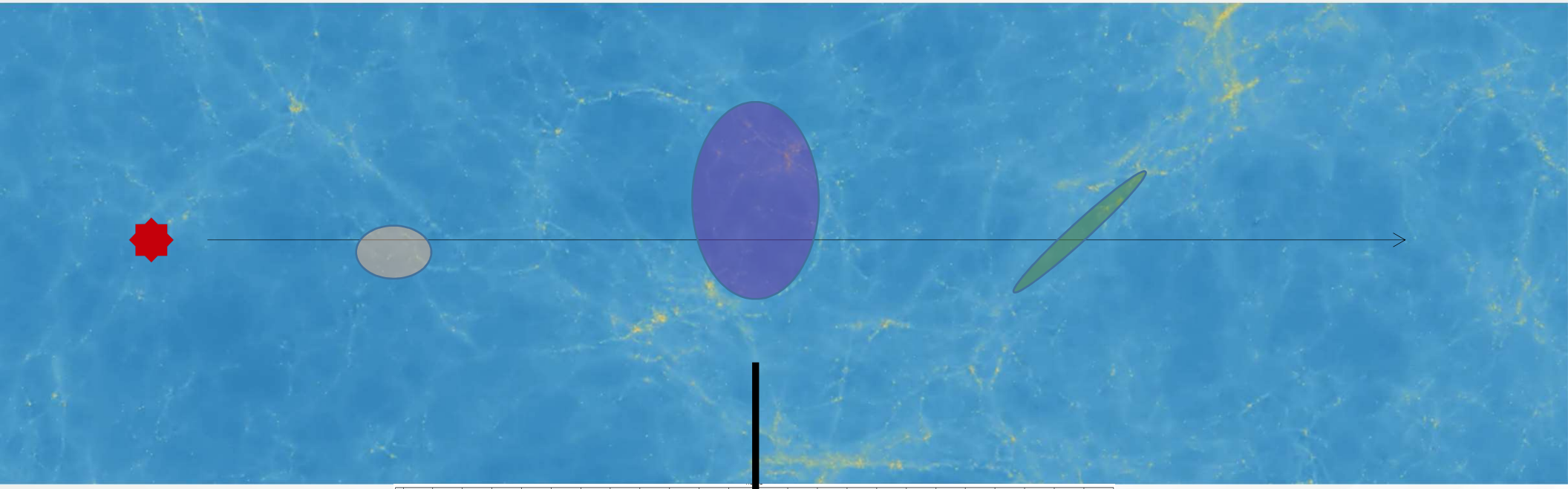
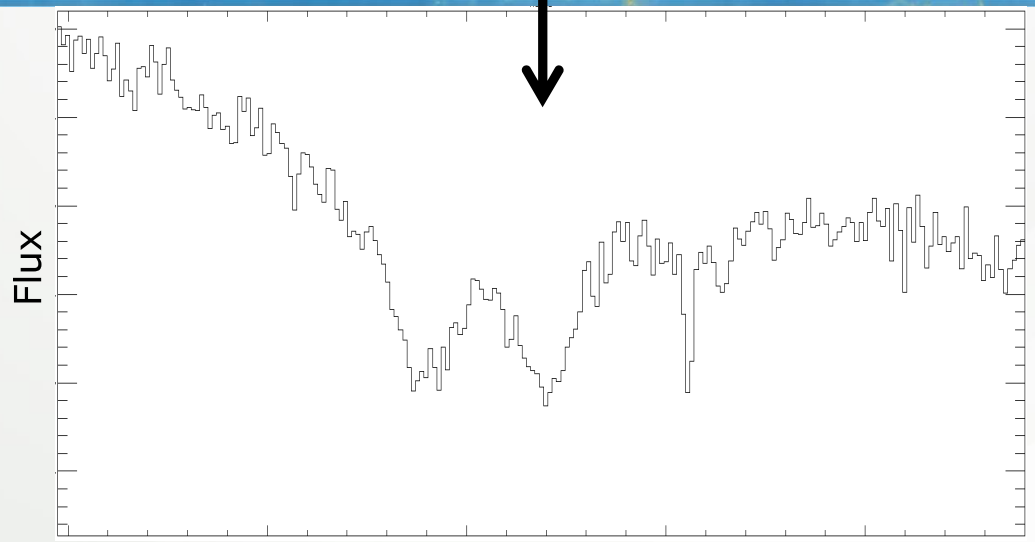




# Measuring Metal Enrichment of the CGM using Absorption

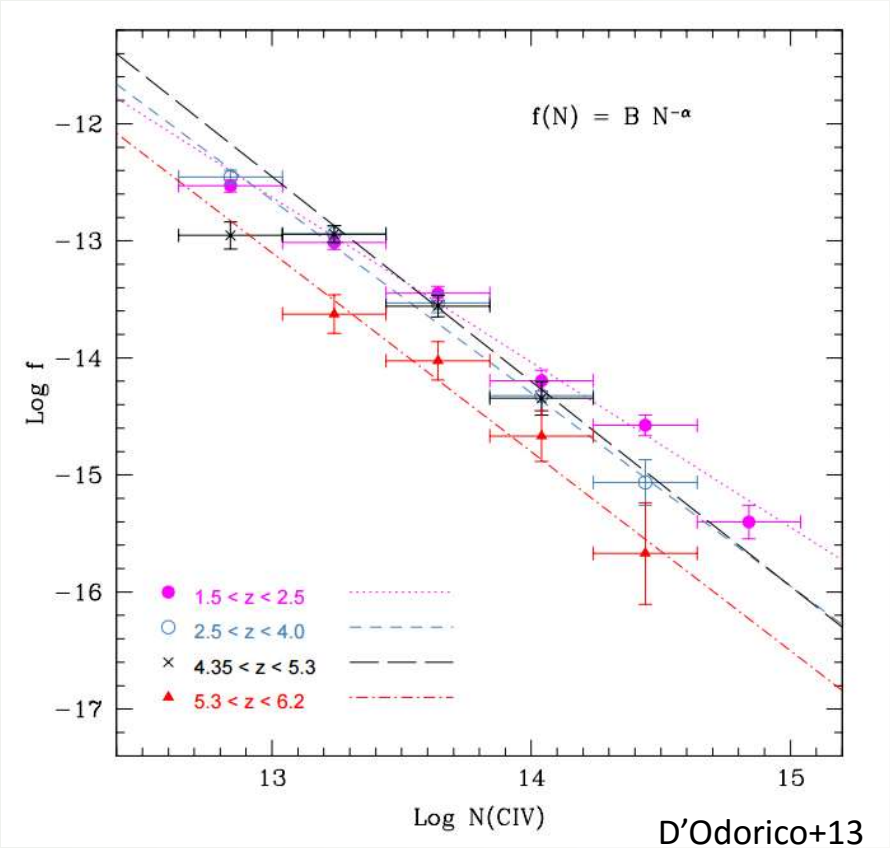
- How are metals produced at early epochs and how do they circulate through the circumgalactic medium?

# Measuring Metal Enrichment of the CGM using Absorption

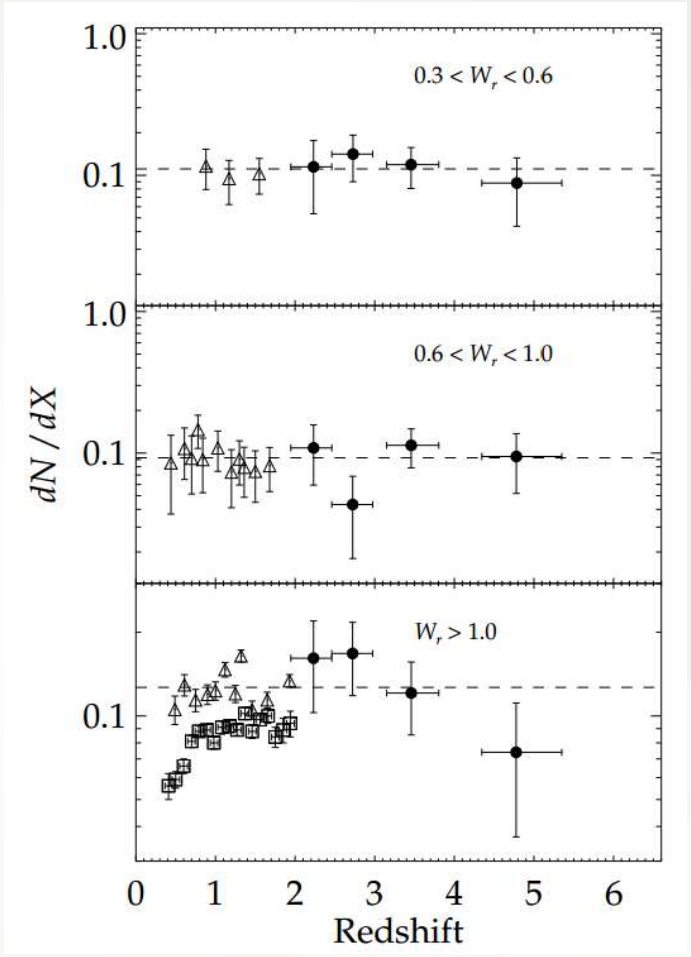
- Presence of metal ions will depend on:
  - Presence and abundance of element: can serve as proxy for SFR
  - Ionisation field: strength and spectral shape of UVB + proximity effects

- Metal lines constrain models of galaxy feedback

# What we know so far




D'Odorico+13

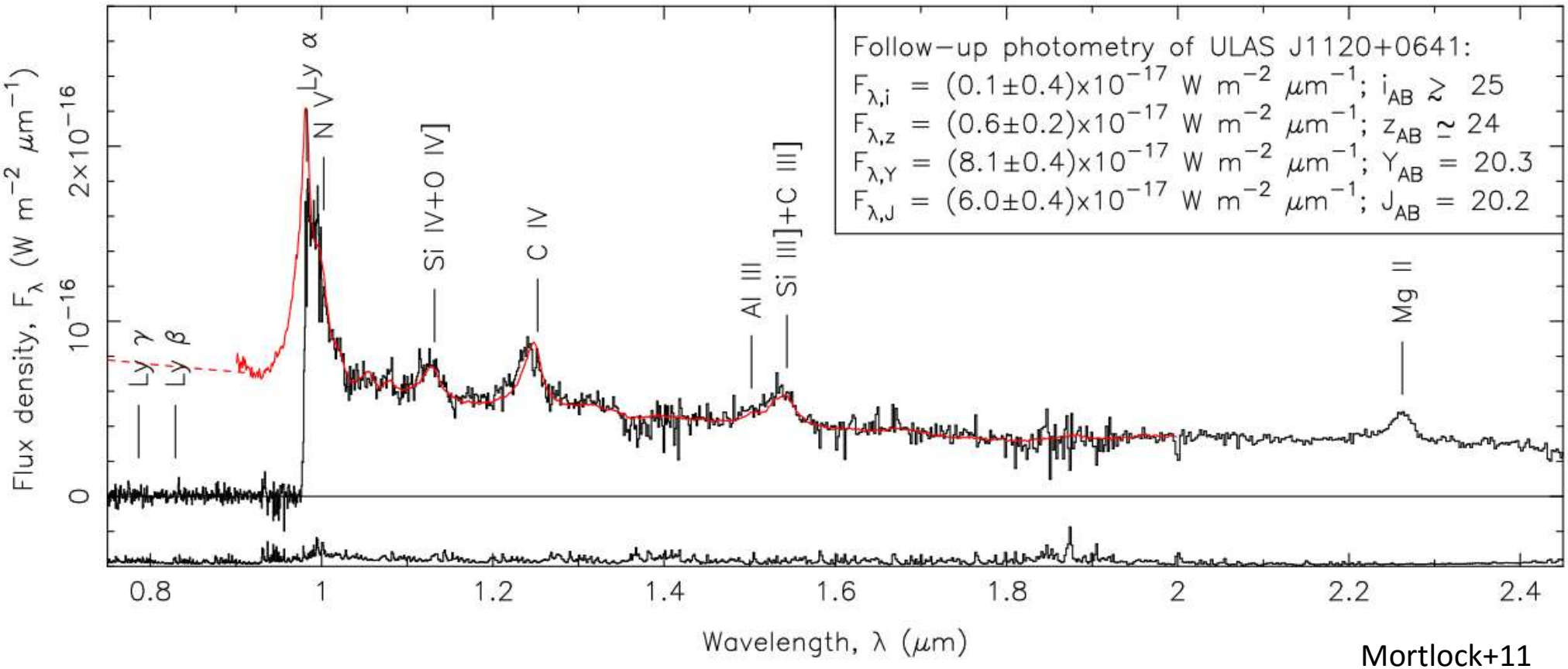



Matejek & Simcoe 11

Highly ionised absorbers (e.g. C IV) go missing with redshift at z > 5.3

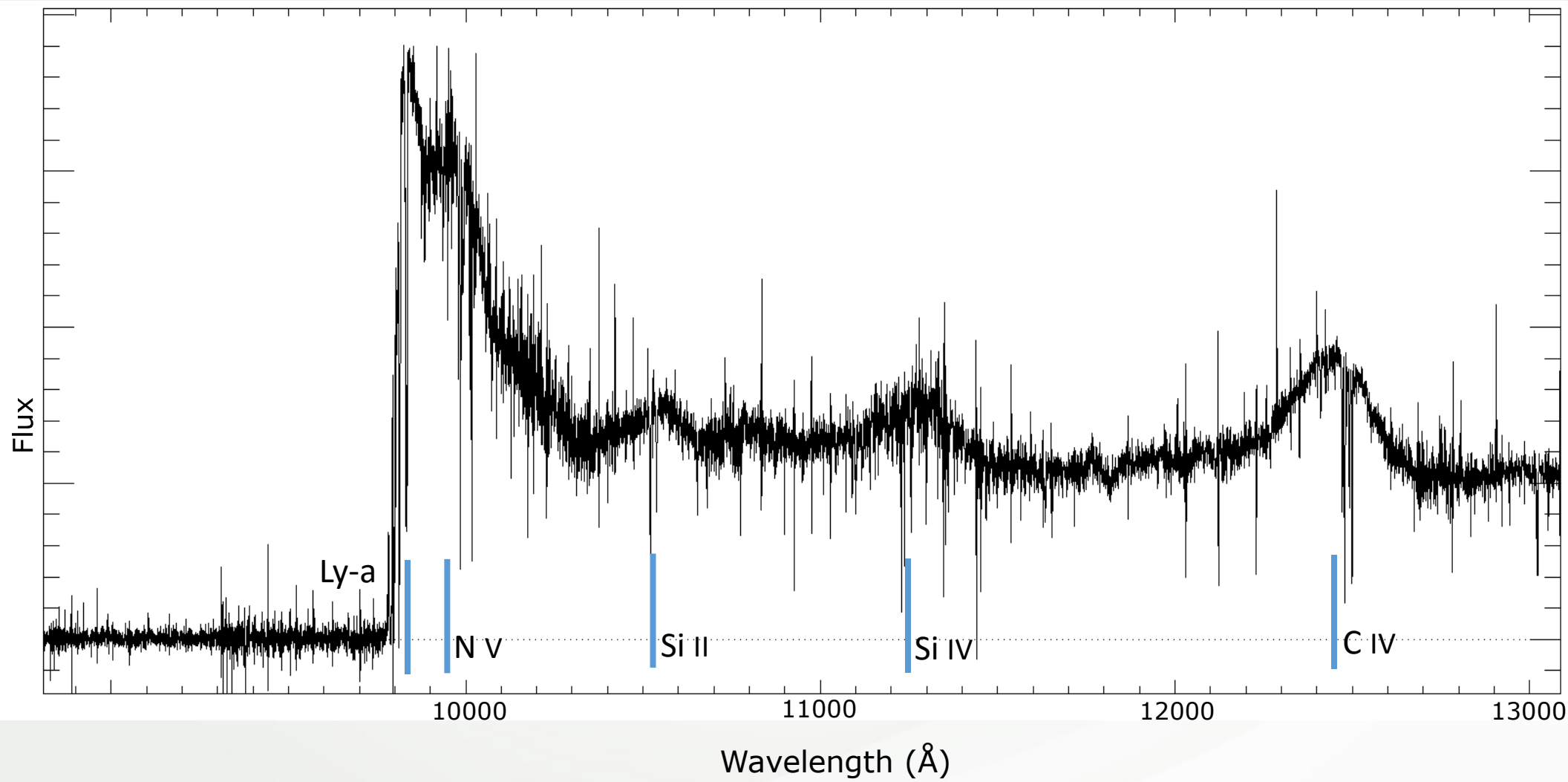
Weak Mg II systems remain constant with redshift – strong ones may track SFRs

# Highest redshift line of sight: ULAS J1120+0641 at z = 7.0842



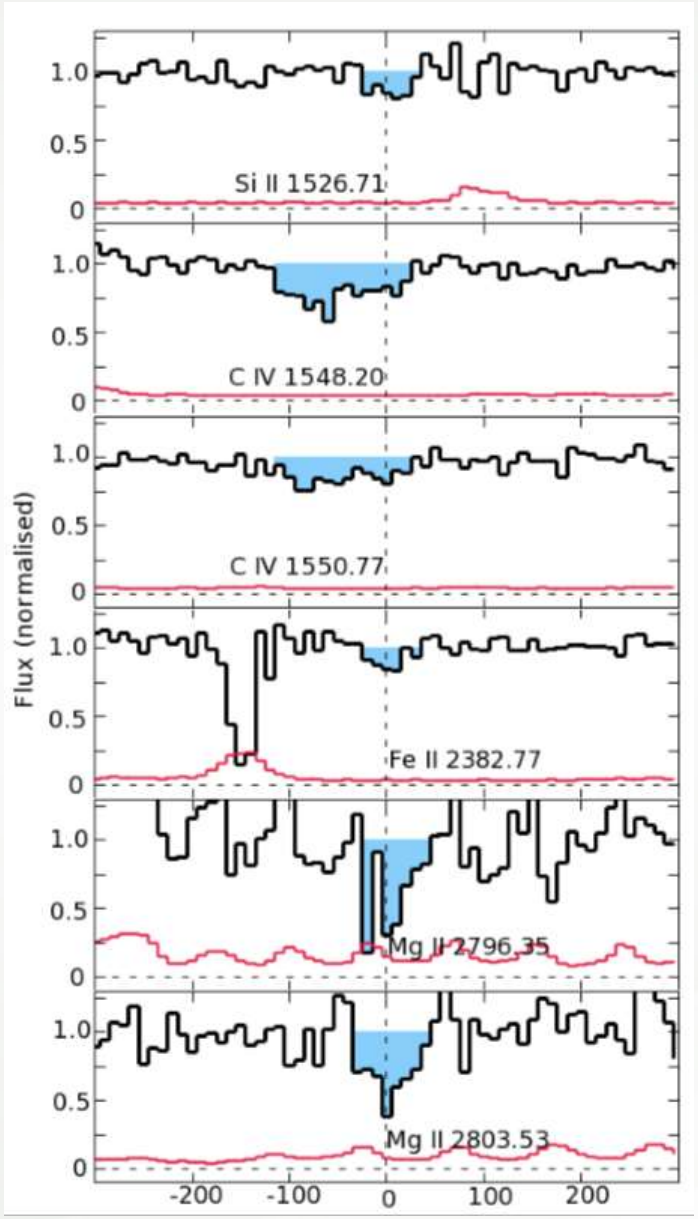

Mortlock+11

# Highest redshift line of sight: ULAS J1120+0641 at z = 7.0842



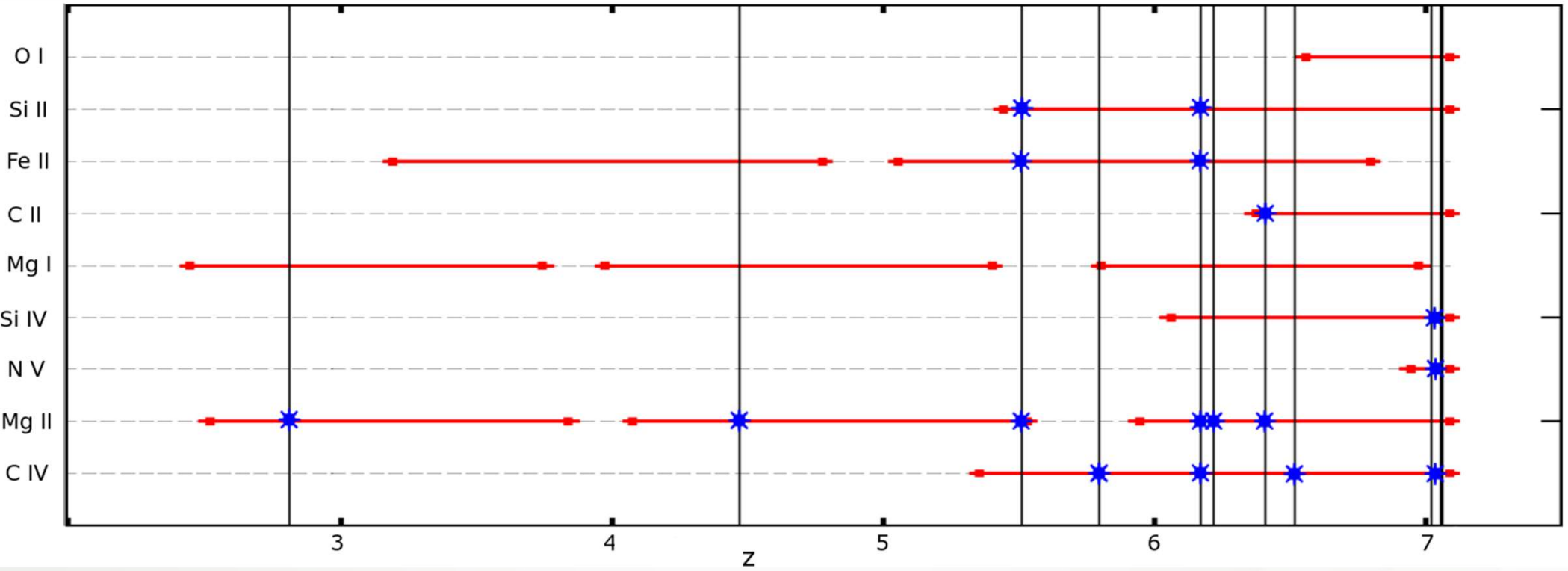

PI George Becker

# Results




Example system found at z = 6.1711

# Results

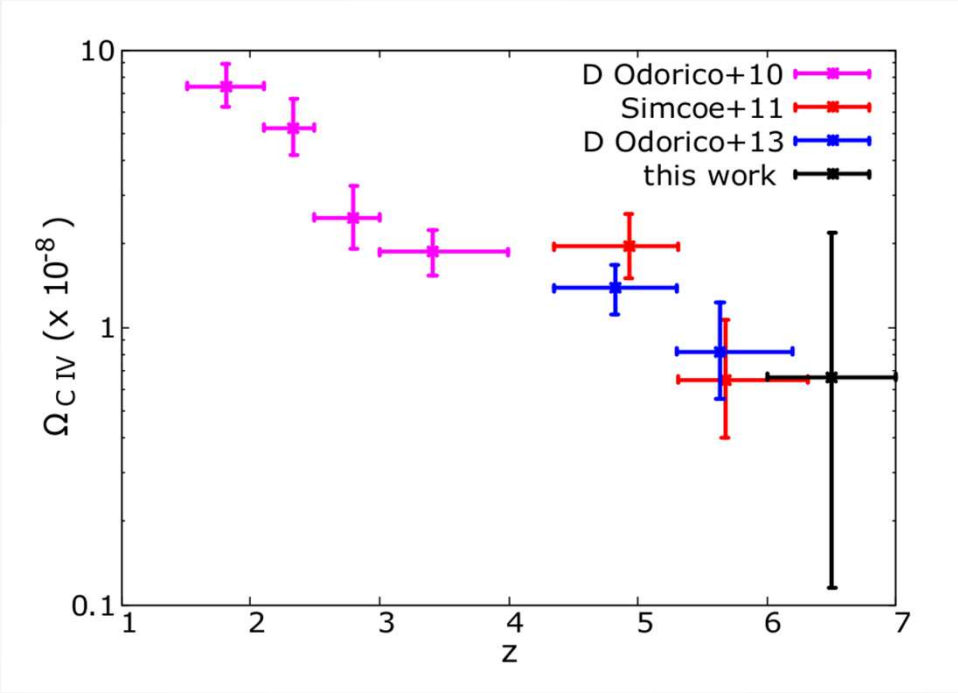



- 6 intervening $z > 5.5$ systems
- 3 associated $z \sim 7$ systems
- Highest-z system: C IV at $z = 6.51$

detection

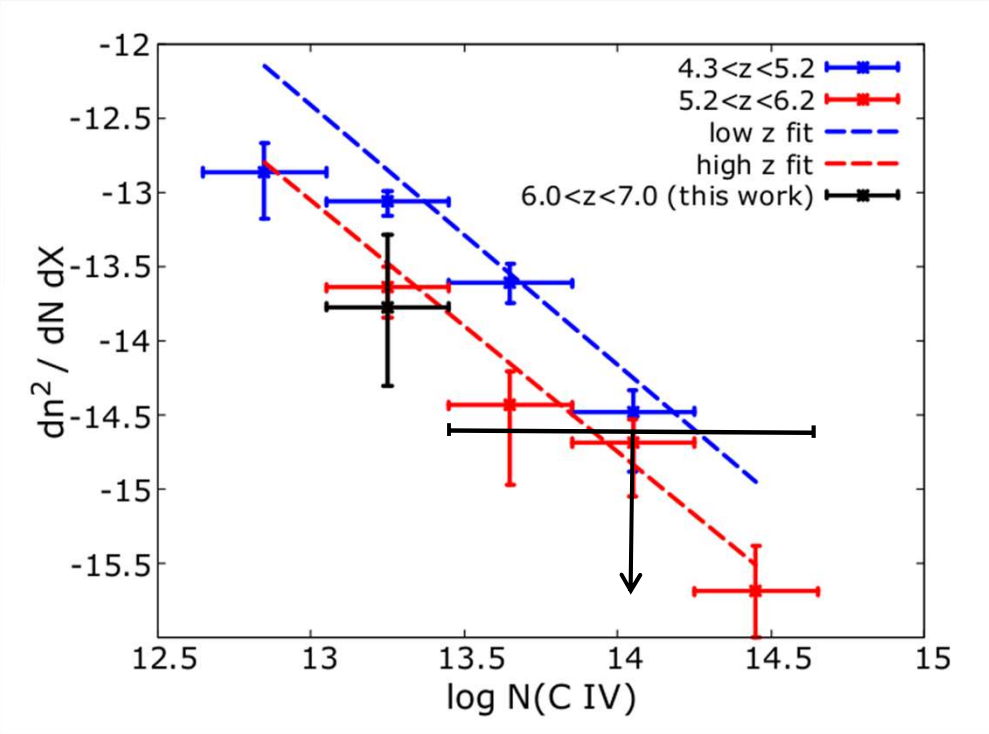
detectability range

# C IV consistent with z ~ 5-6 ?



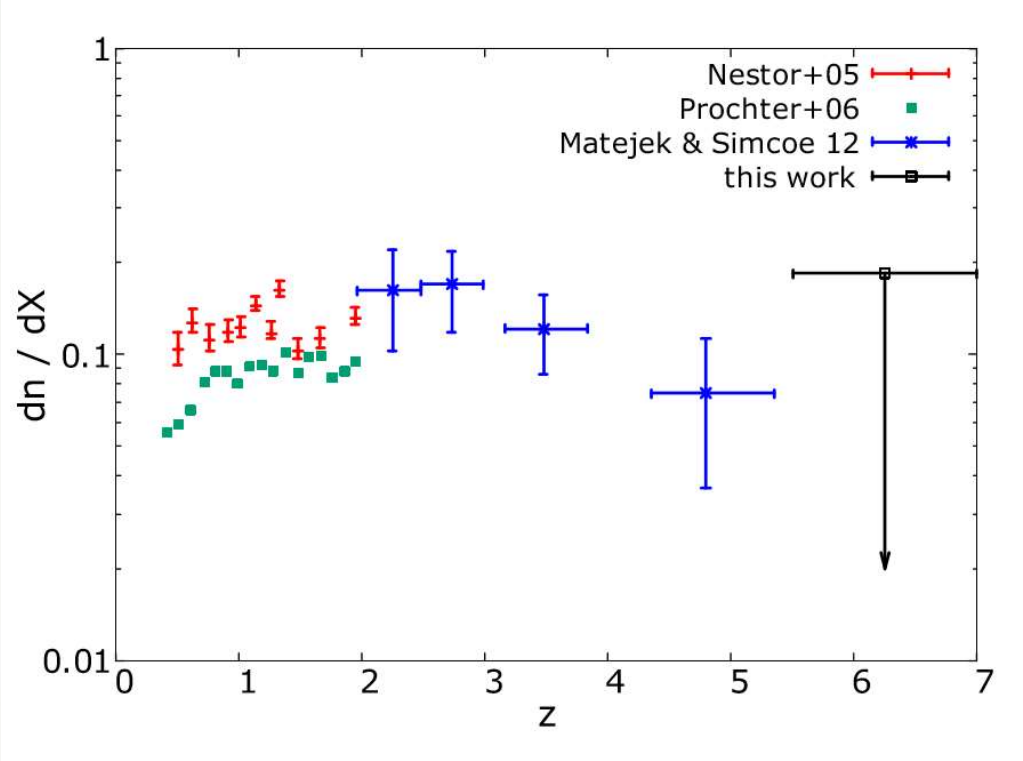

- Cosmic mass fraction of C IV contained in strongly absorbing systems is observed to decline from z = 1 to z = 5.5
- This trend continues or slows down up to z = 7

# C IV consistent with z ~ 5-6 ?



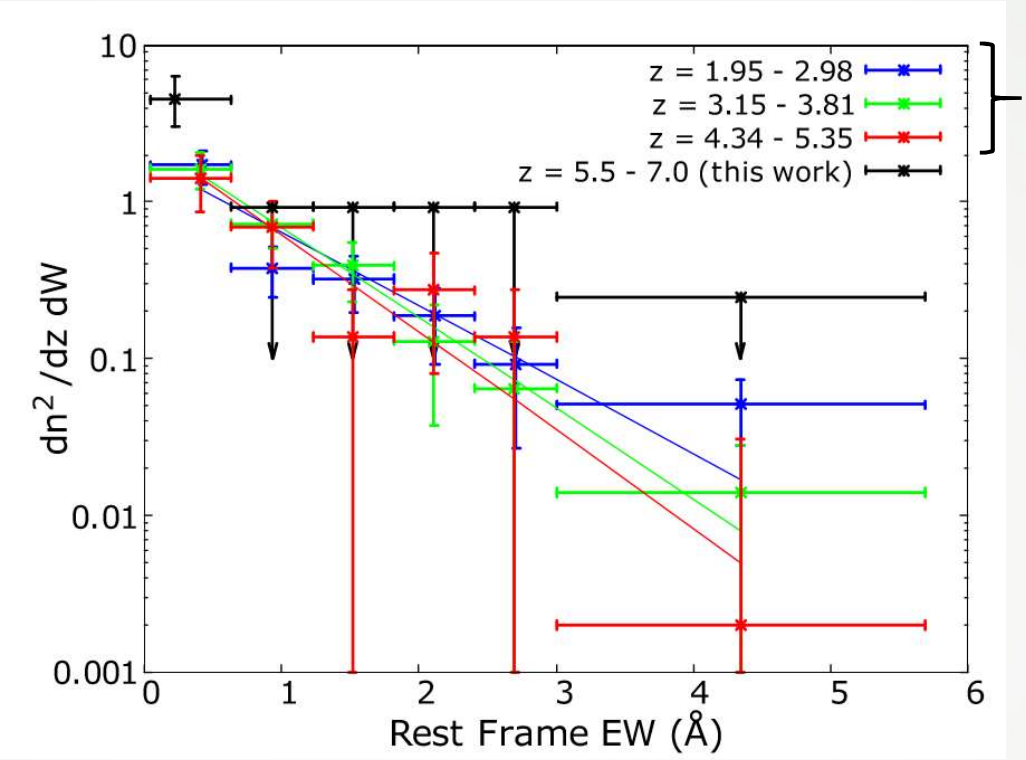

- We detect no strong systems, but expected number based on lower-z abundances was <~1

# No strong Mg II observed



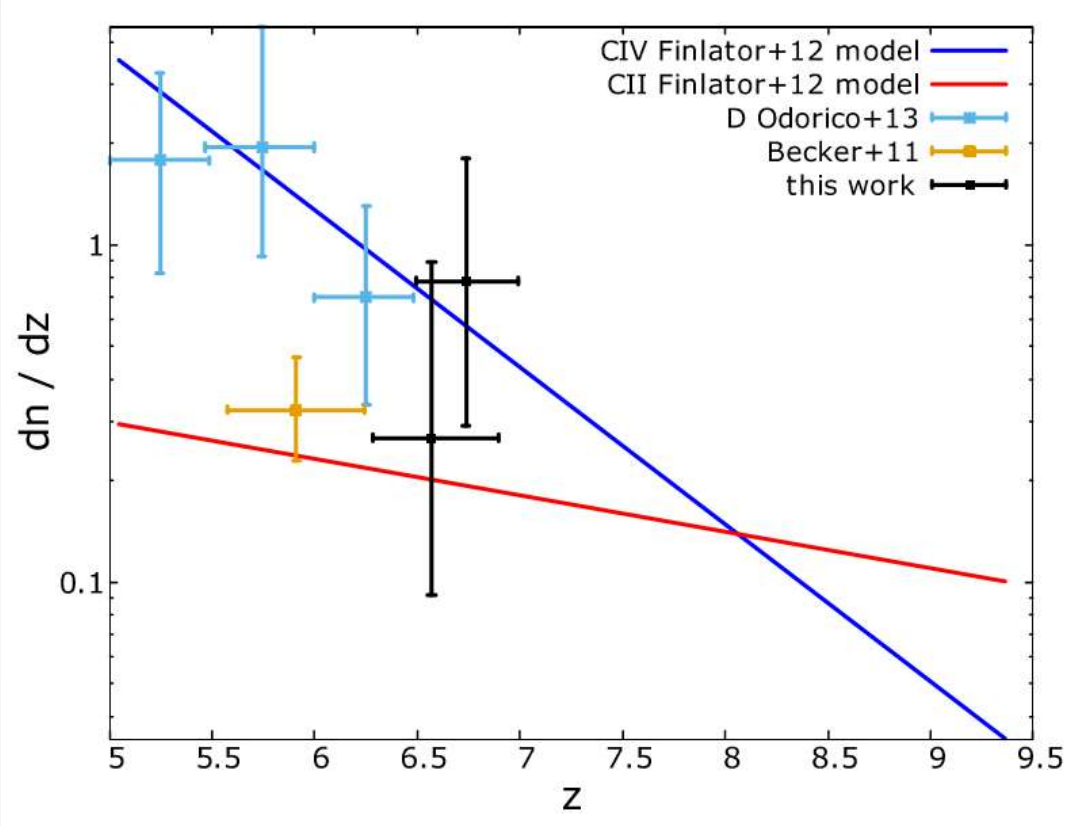

- We find no strong Mg II, but this gives a poor upper limit

# Overabundance of weak Mg II




- We find 4 weak Mg II systems where ~1 was expected
- Significant disagreement with $z < 5.4$ distribution

# C II versus C IV




- Simulations (Finlator+12) predict crossover of C II and C IV occurence at z~8 – our detections of both ions are in agreement with this

# Conclusions

- We have extended contraints on high-redshift metal absorbers to higher redshifts than previously probed.
- Occurence of highly ionised metals (C IV) appears to be consistent with z~5.
- Overabundance of weak Mg II found at z > 5.5 – could be linked to previously found increase of O I with redshift.
- Since metal enrichment increases with time, this points to evolution in the UVB at z > 5.5

# Associated Absorbers