

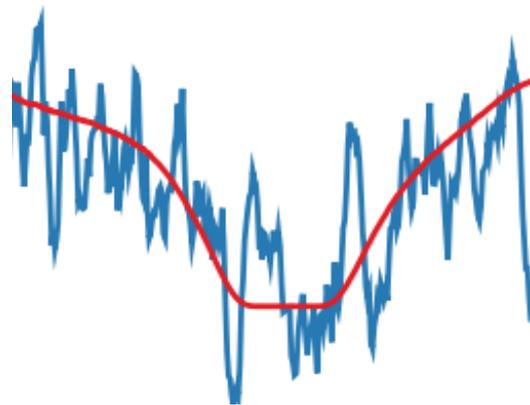
Teaching Computers to Detect DLAs

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Simeon Bird, Shirley Ho.

1605.04460, 1610.01165

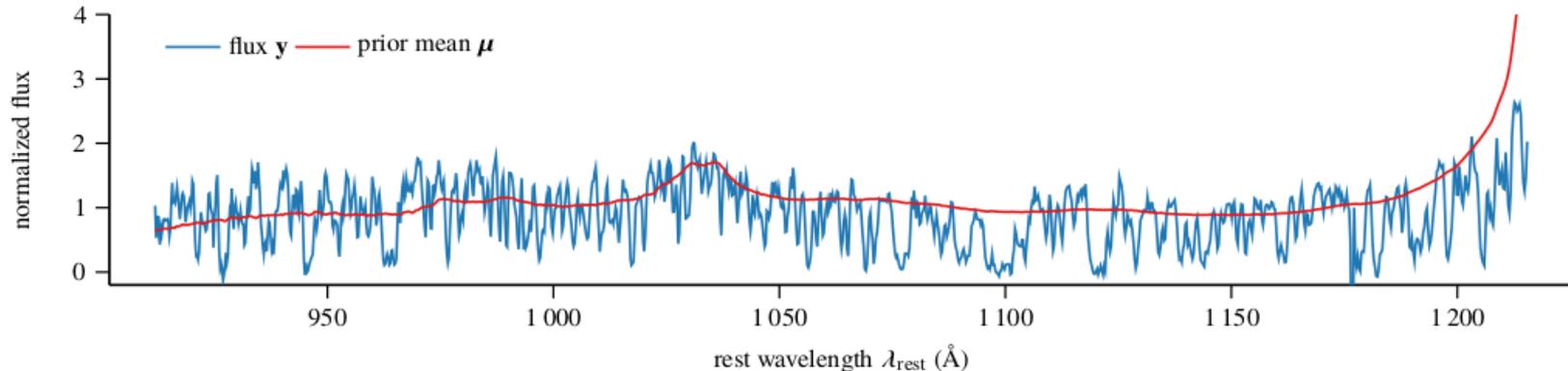
Strong absorbers in quasar spectra

Neutral hydrogen from small galaxies



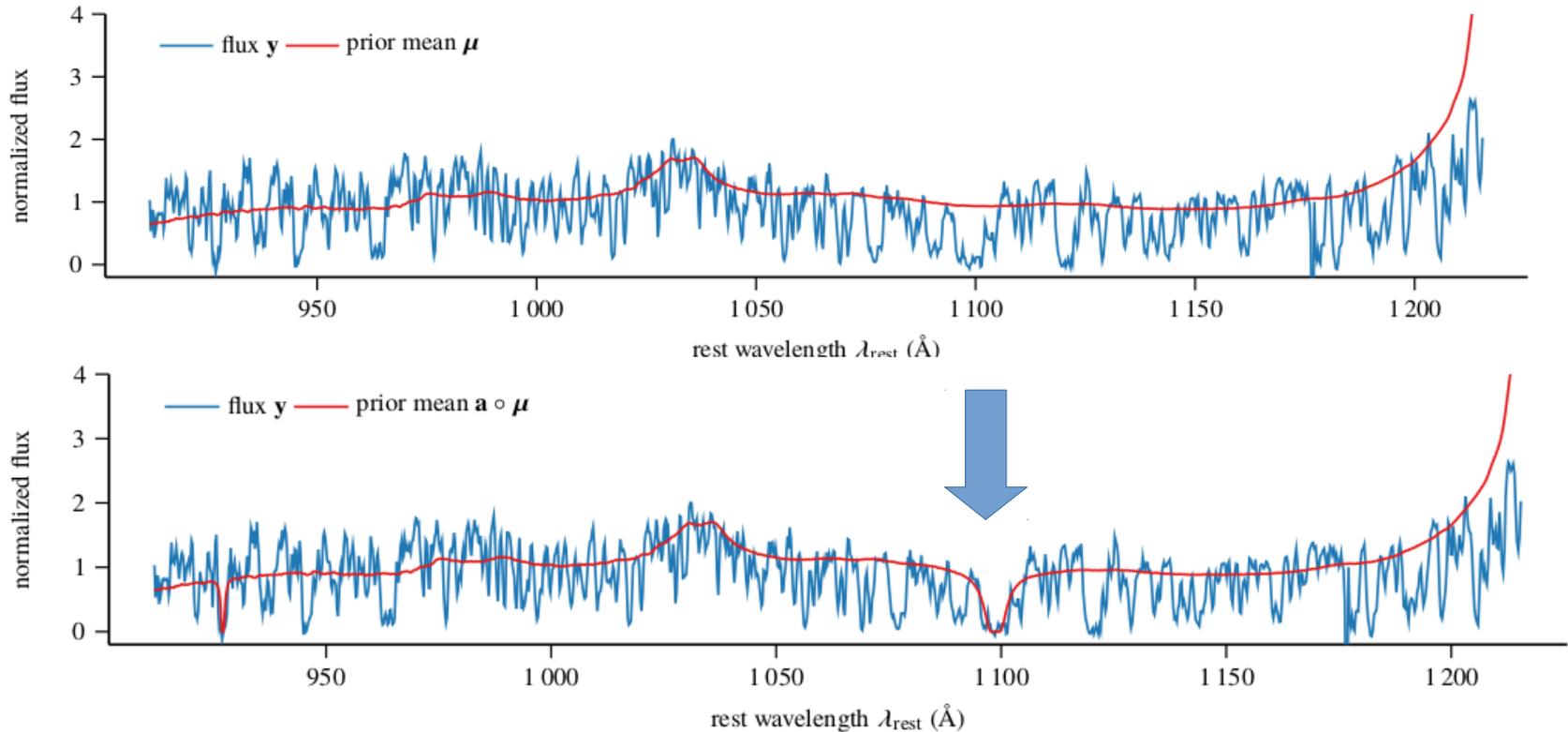
Finding DLAs in Spectra

Currently done by **visual inspection** of spectra
Look for wide dips in the spectrum below:



Finding DLAs in Spectra

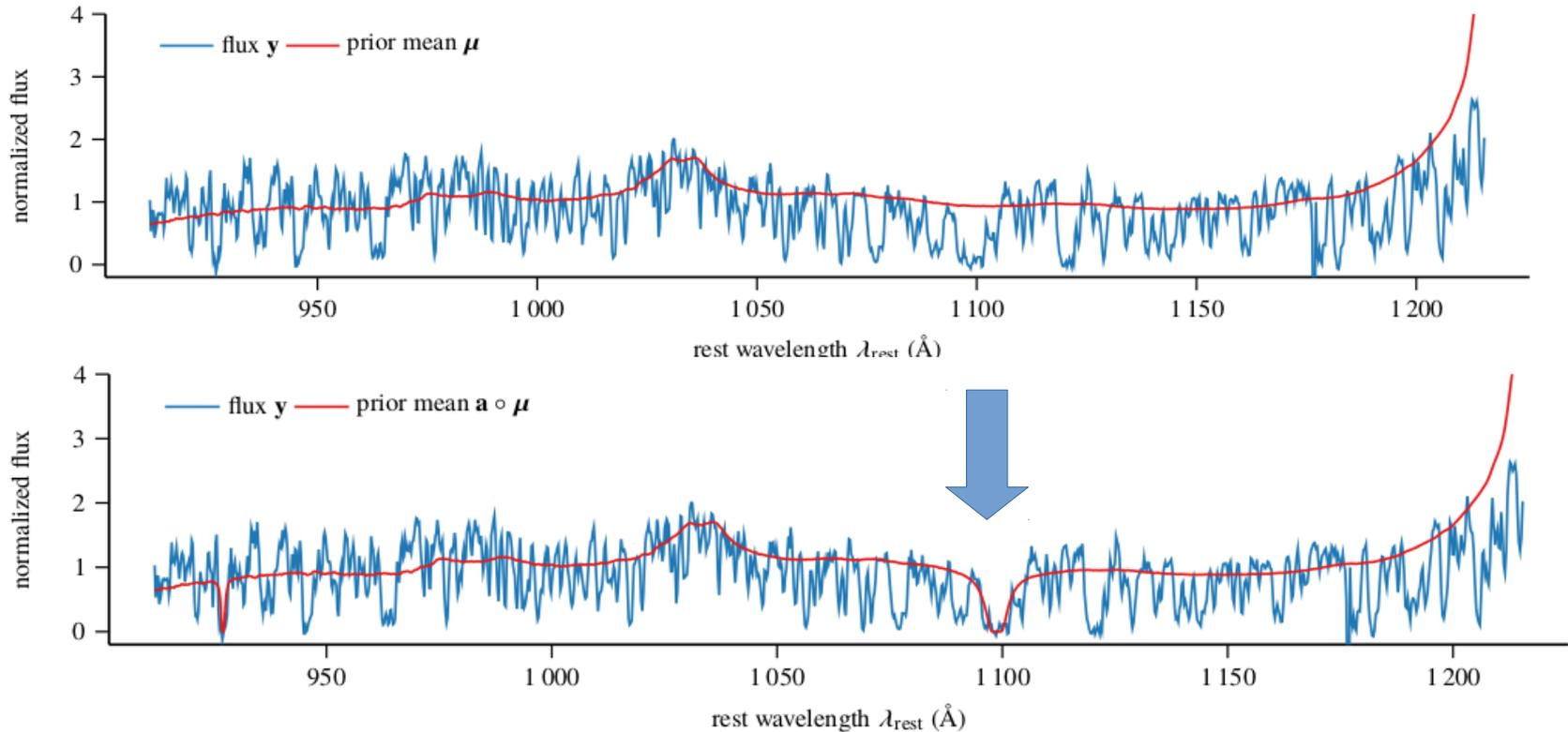
Currently done by **visual inspection** of spectra
Look for wide dips in the spectrum below:



Finding DLAs in Spectra

Future surveys will have $> 10^7$ spectra

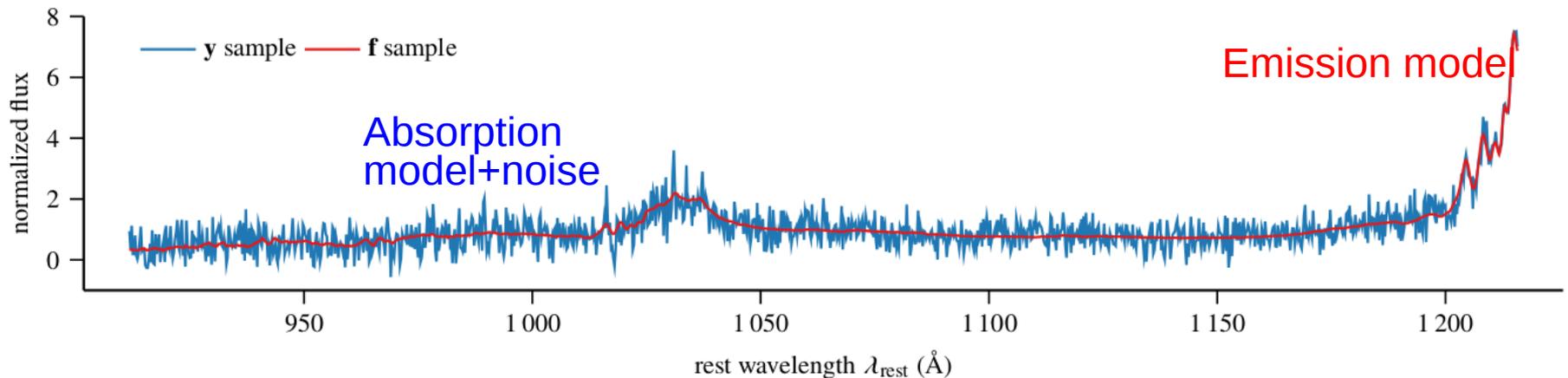
Visual inspection clearly **impractical**



Finding DLAs in Spectra

Learn Bayesian model for quasar without DLA

Learn and test with DR9 visual catalog

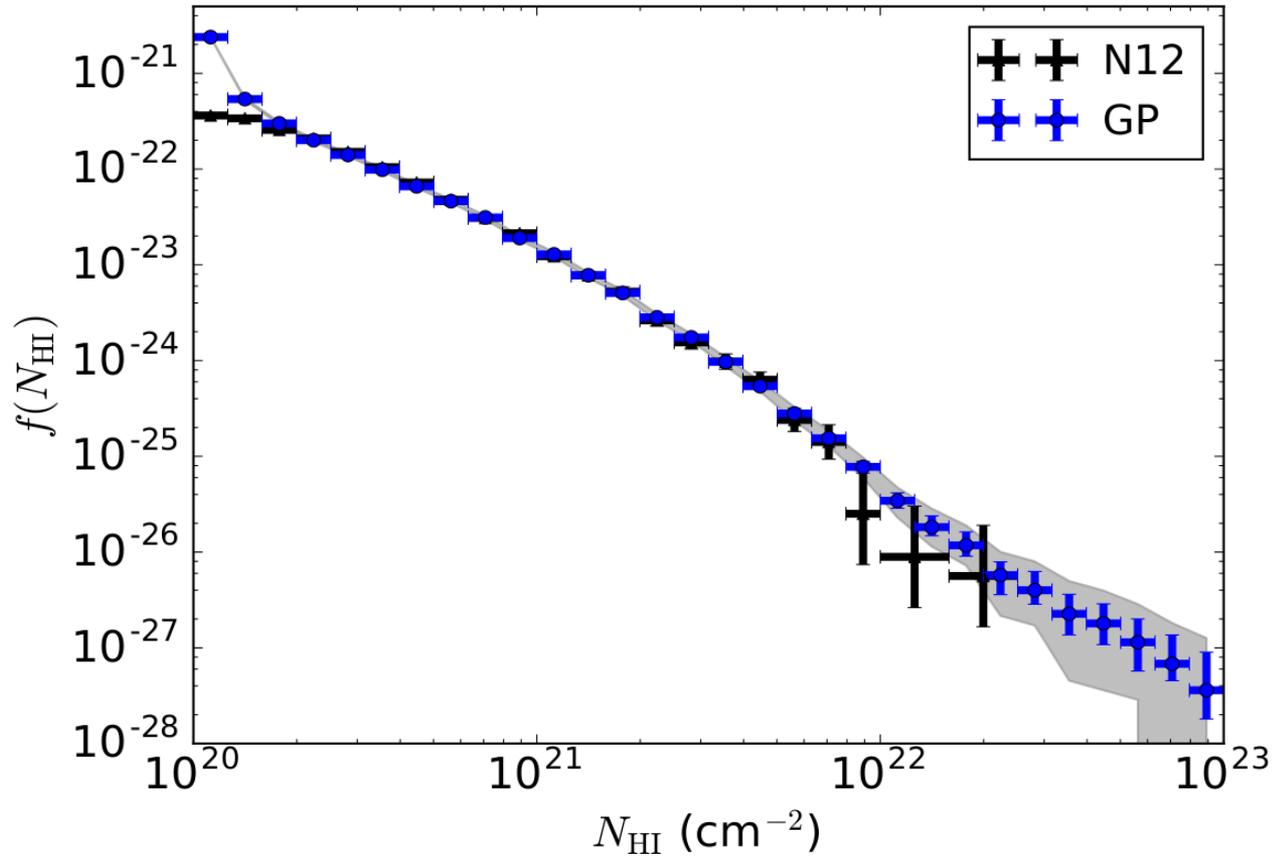


Model for DLA added using Voigt profile

Detecting DLAs

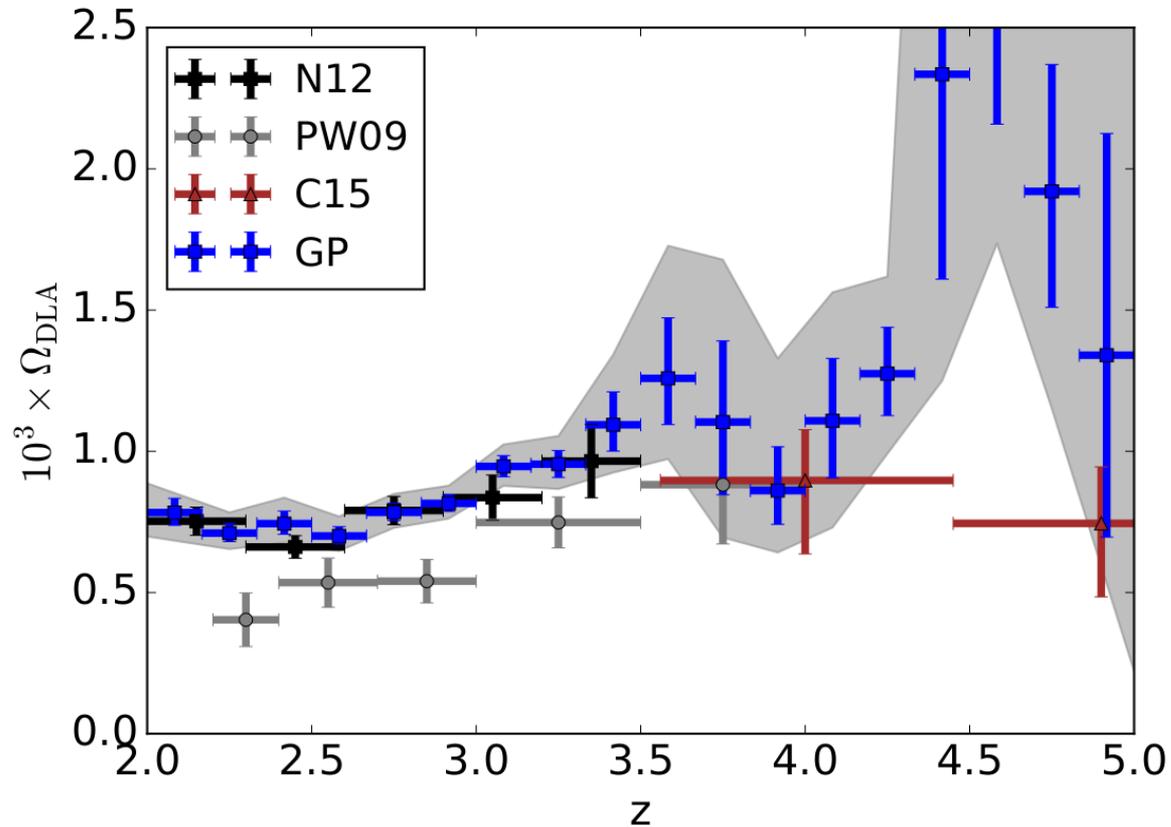
- This gives us **posterior probability** for DLA
- We can build an accurate model for DLA population even with poor detections
- Use all data, even with $\text{SNR} < 1$

Results: CDDF



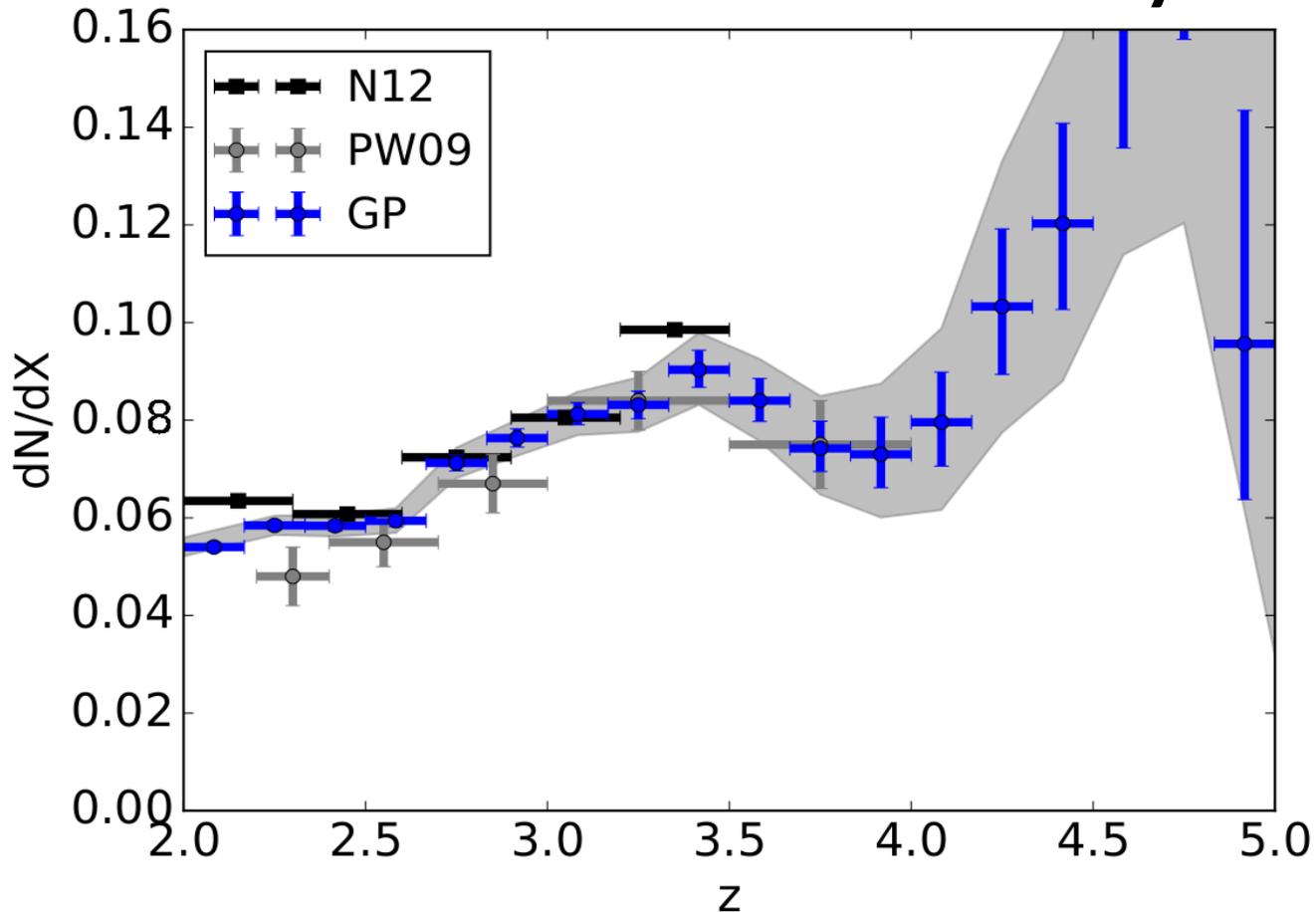
- Reproduce earlier datasets
- Small error bars!

Results: OmegaDLA



- Total gas mass in DLAs.
- Good agreement and $z > 4$

Results: Line Density

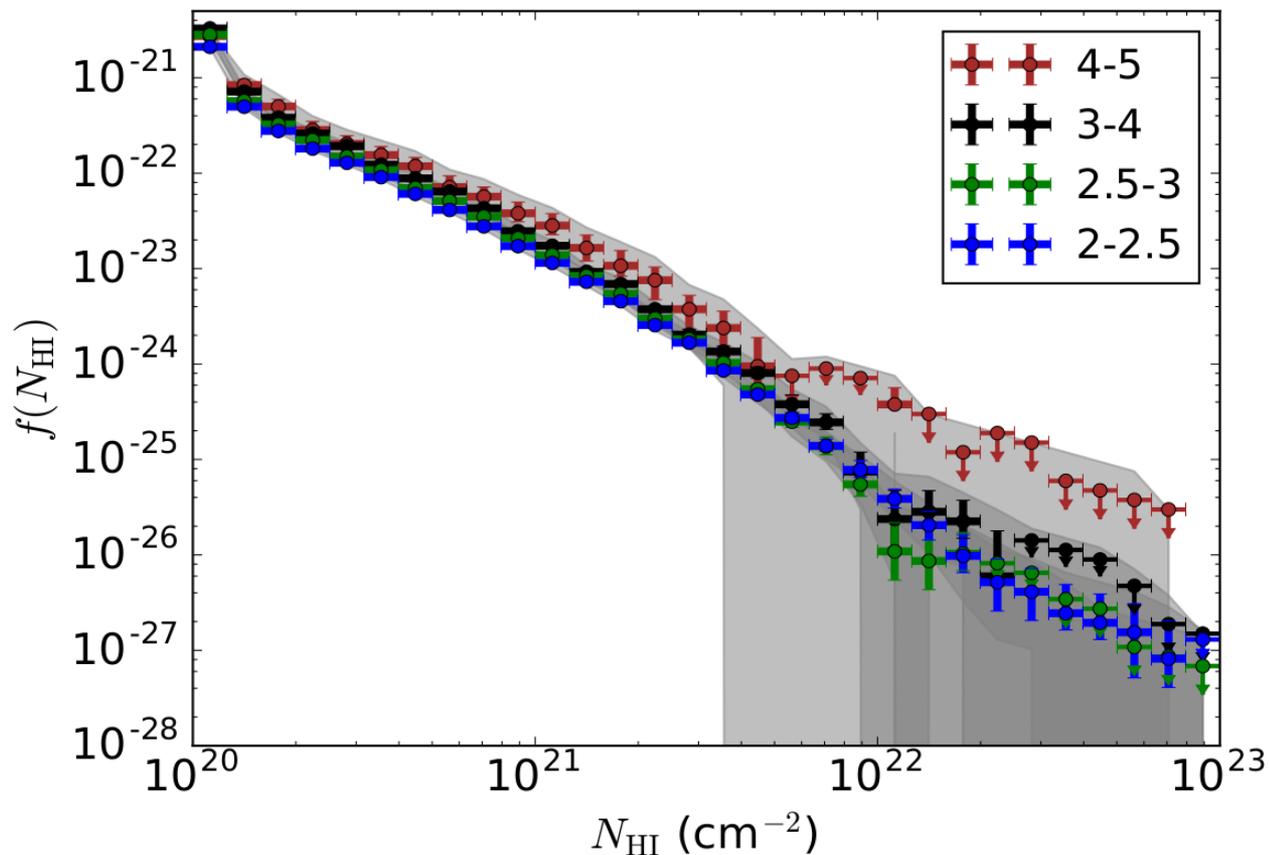


- Number density of DLAs increases
- Error bars!

Conclusion

- Automated detection of DLAs in spectra
- We get a **posterior probability**
- Precise measurement of HI

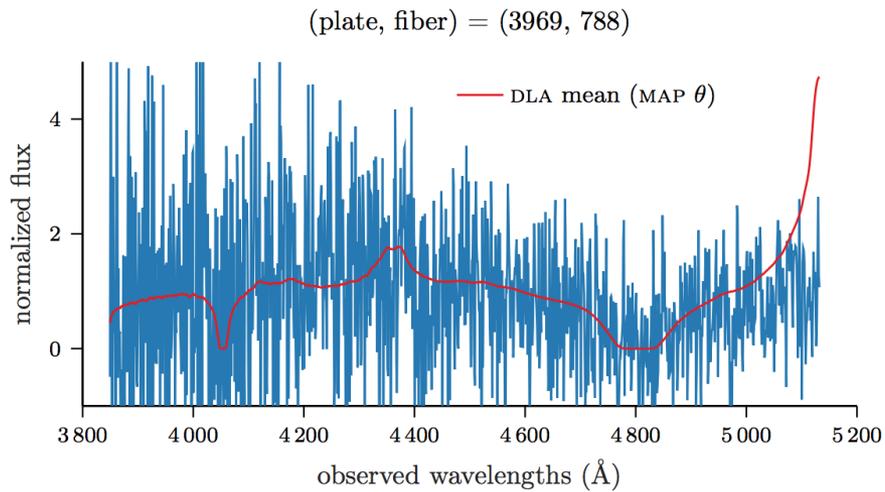
Results: CDDF



- Not much evolution for $z < 4$
- Maybe something at $z = 4-5$

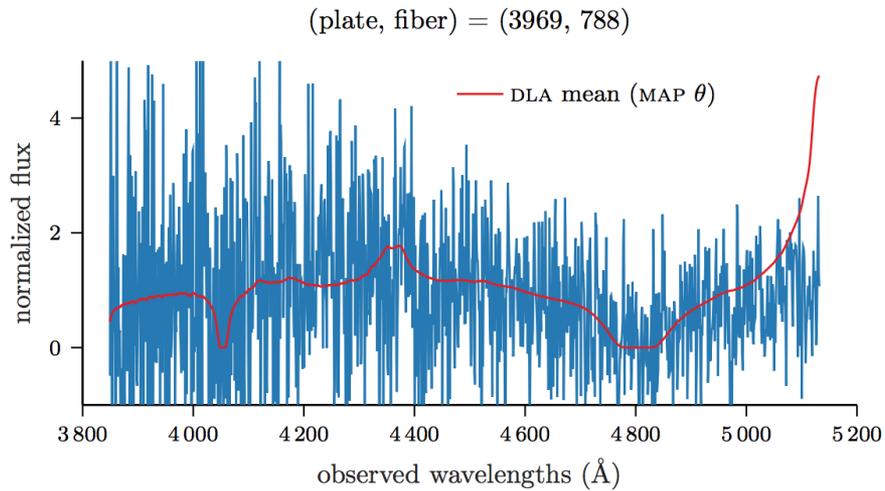
Is this a DLA?

Raw



Is this a DLA?

Raw



Smoothed

