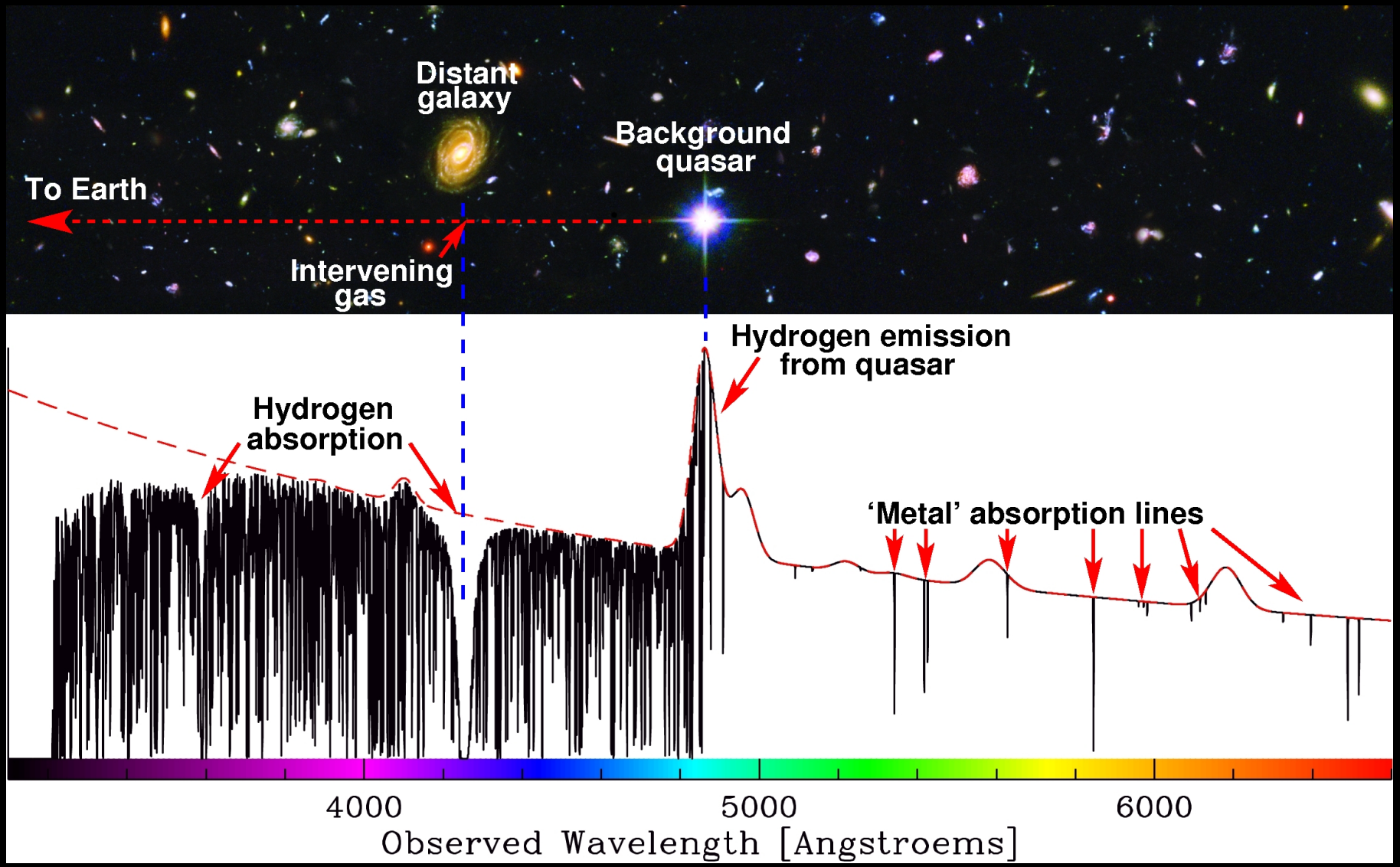
Probing galaxy evolution within the first 3 Gyr: The XQ-100 DLA sample

Trystyn Berg (U. Victoria)
trystynb@uvic.ca

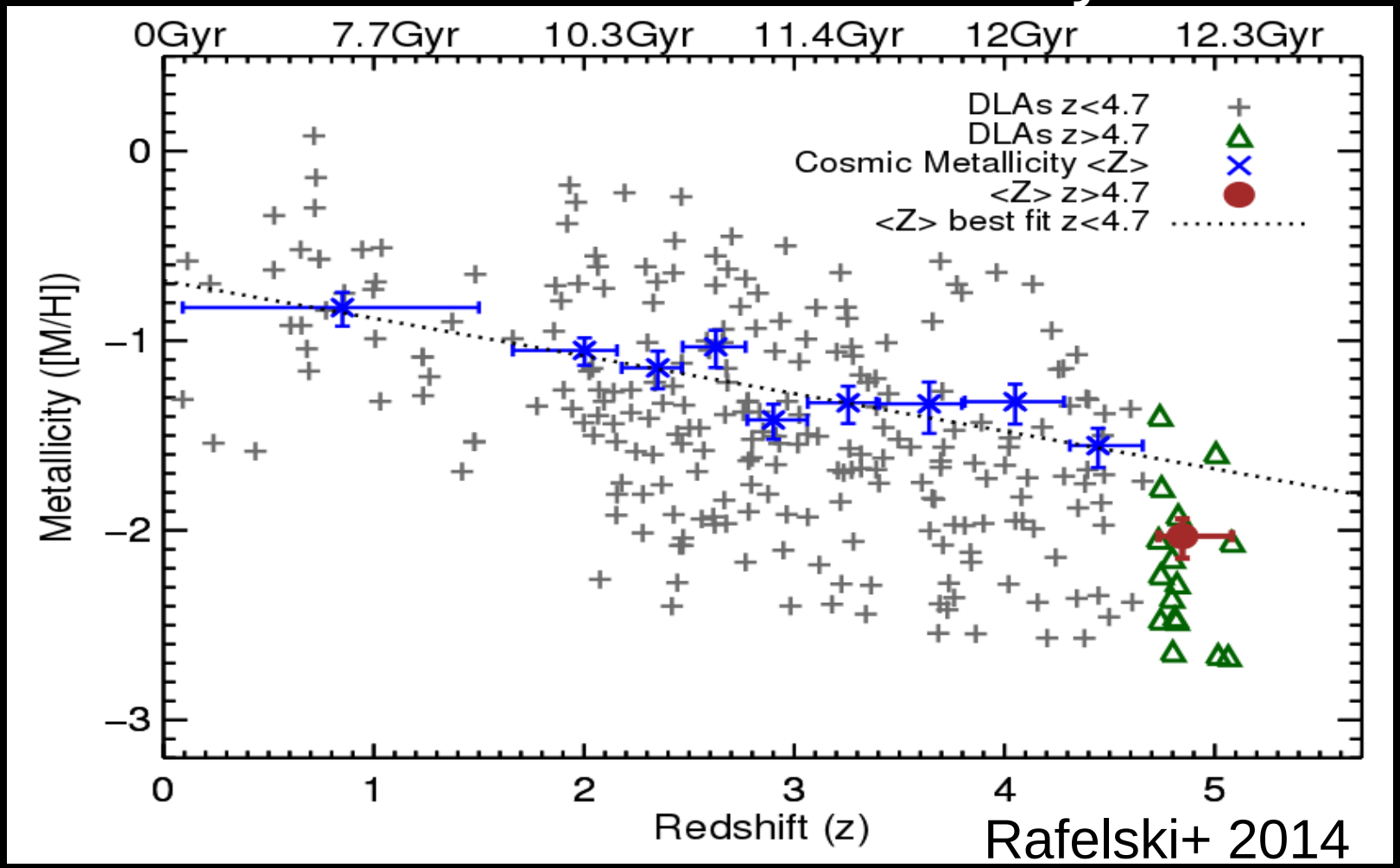
Ruben Sánchez-Ramírez (Bilbao/Granada)
Sara Ellison (U. Victoria)
J.X. Prochaska (UC Santa Cruz)
XQ-100 team

Damped Lyman-alpha systems



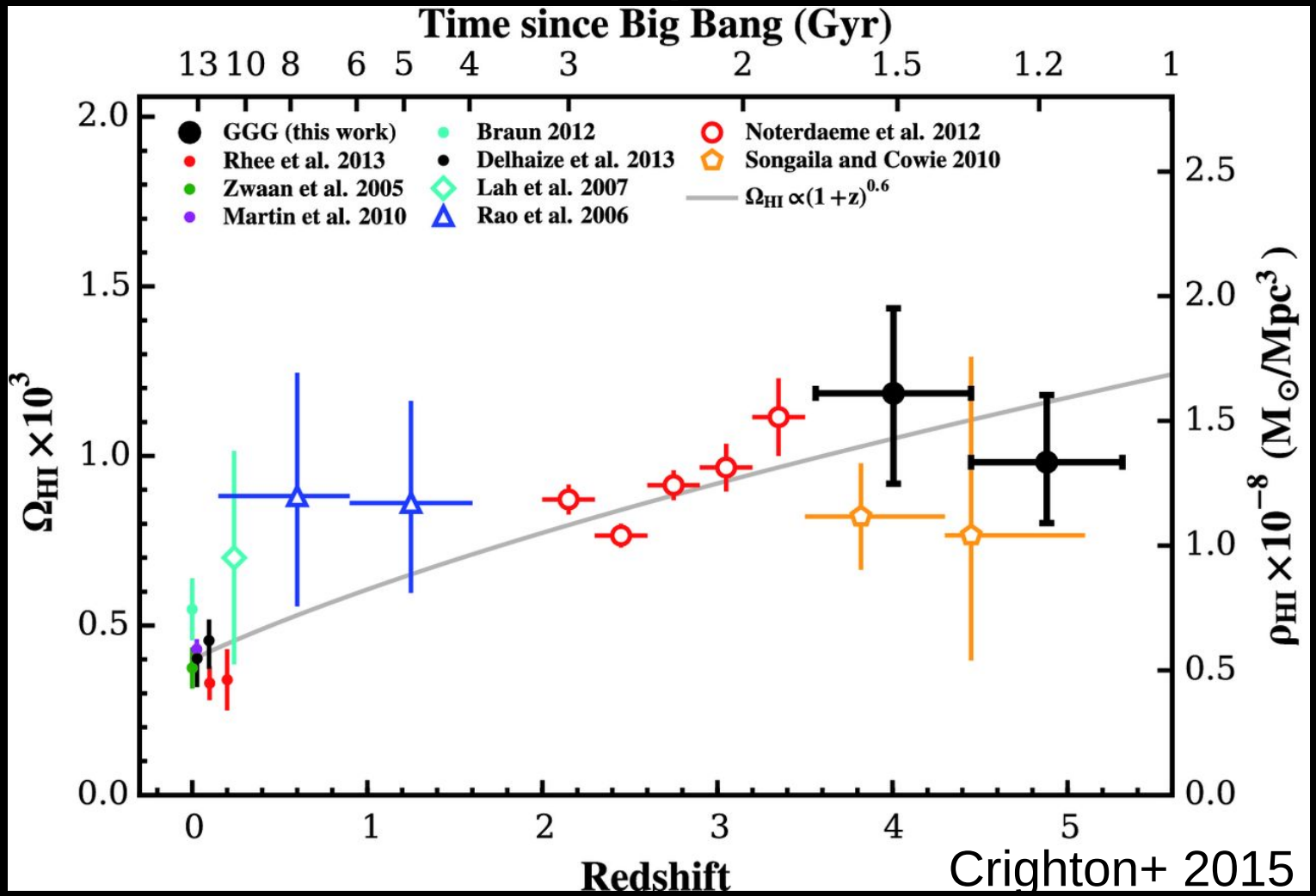
Why are DLAs useful?

- Cosmic evolution of metallicity



Why are DLAs useful?

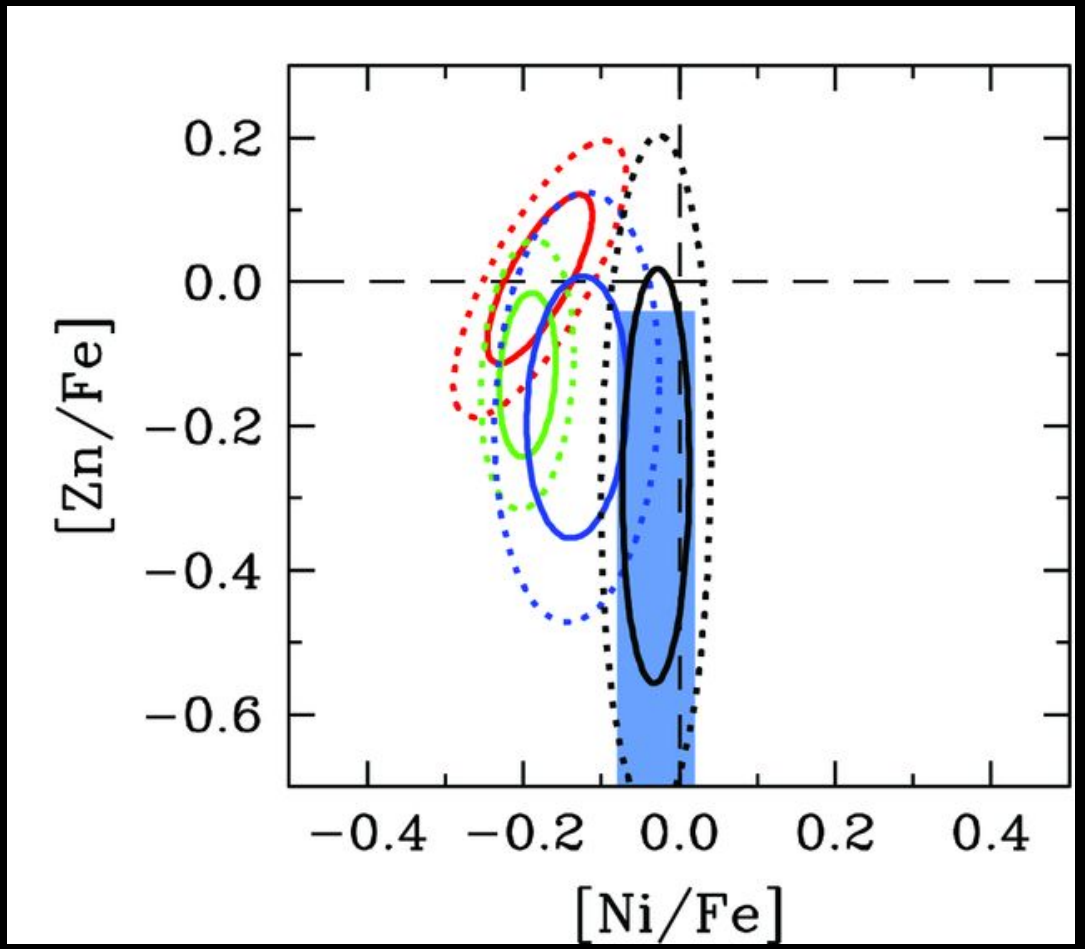
- HI evolution/consumption with time



Crighton+ 2015

Why are DLAs useful?

- Nucleosynthesis

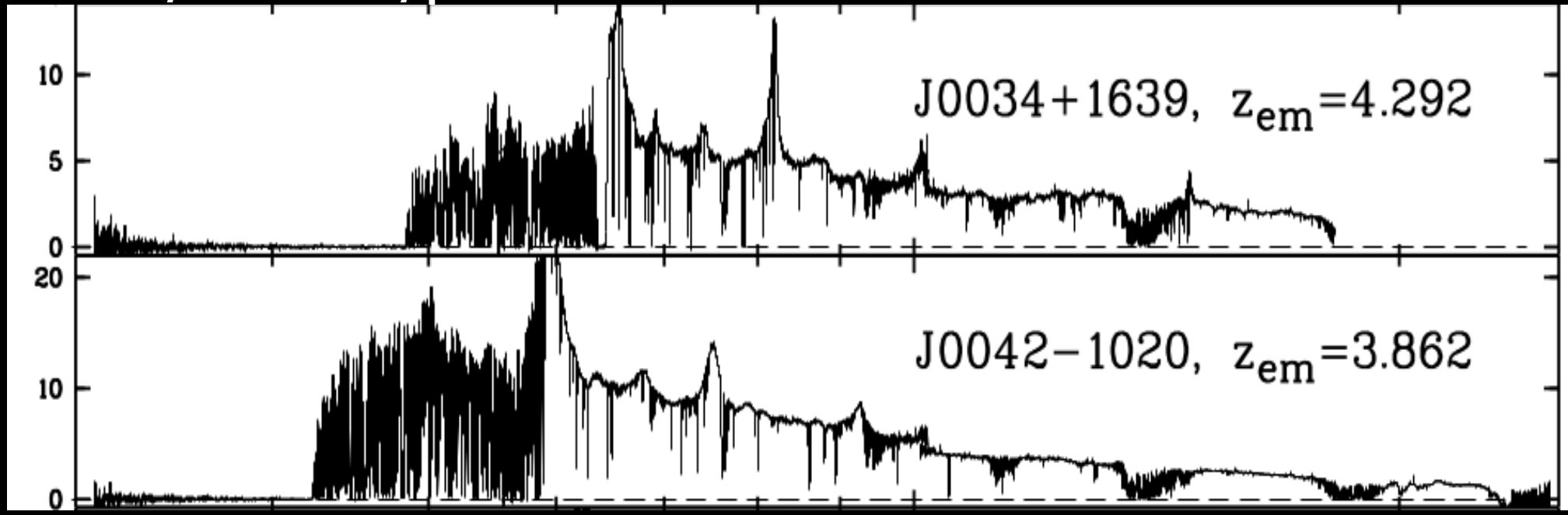


Cooke+13

The XQ100 survey

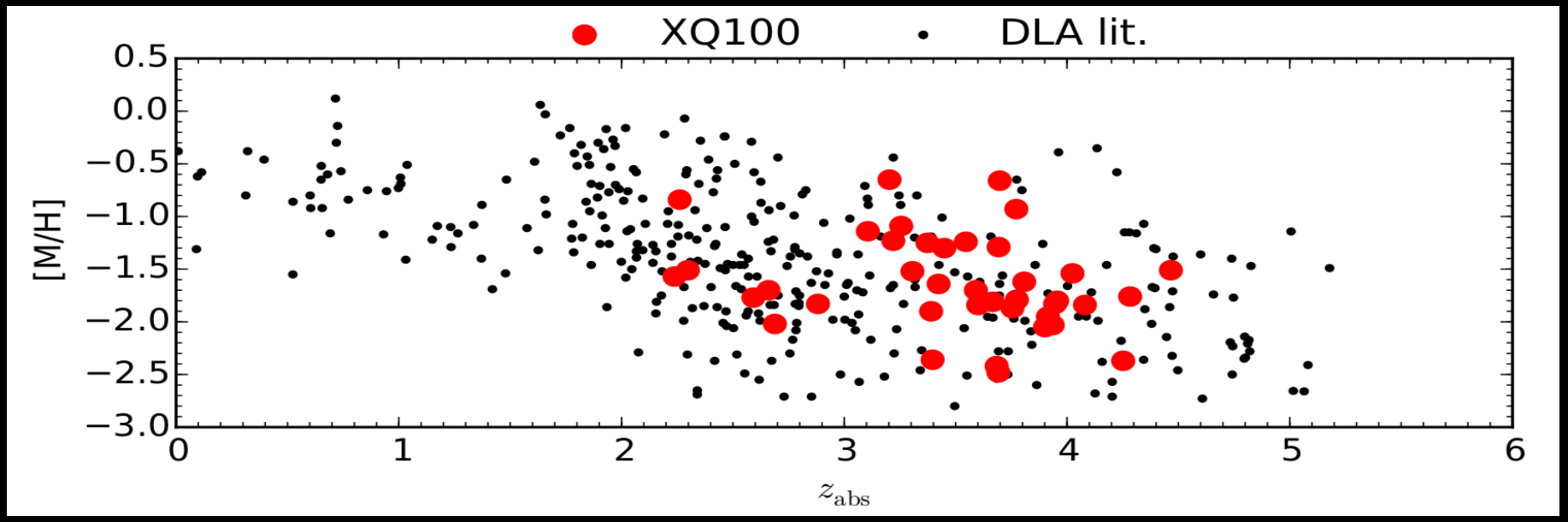
- 100 hours, 100 QSOs with X-Shooter
  - z_{em}~3-4
- Near UV – NIR coverage
- S/N~ 20/pixel

Lopez+ (submitted);
Session 2 talk!



(sub)DLA survey

- Identified absorbers down to logN(HI)=19.5
- HI (Sánchez-Ramírez+; submitted) and metal (Berg et al.; in prep.) derived for 38 DLAs



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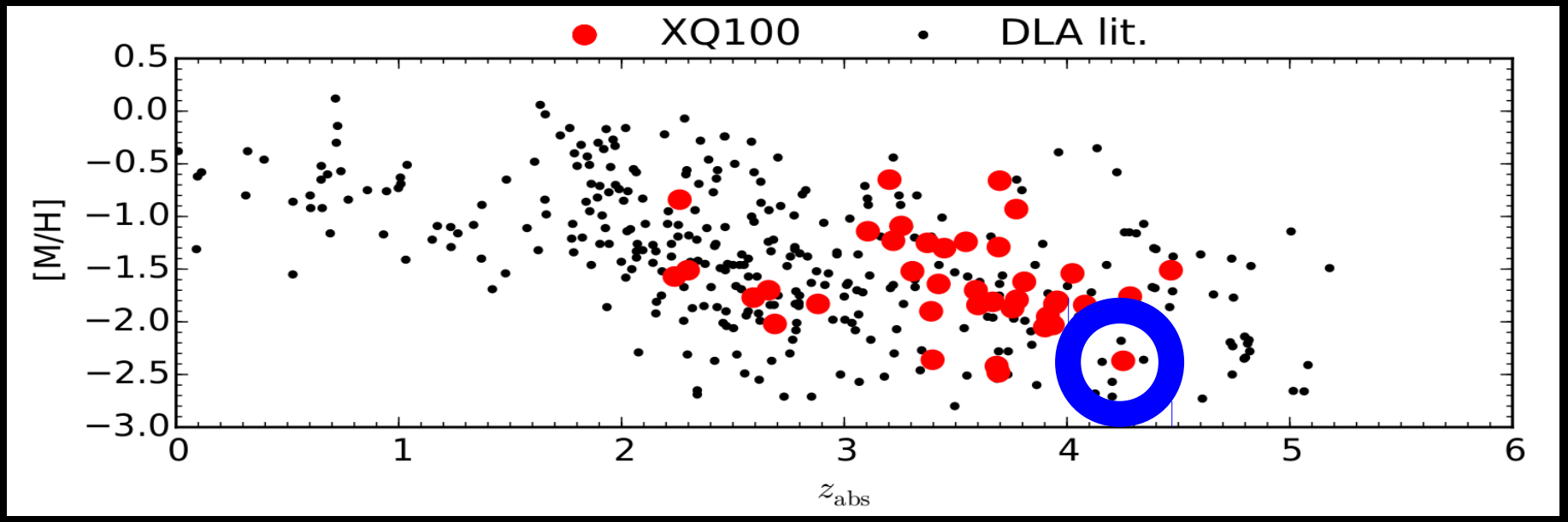
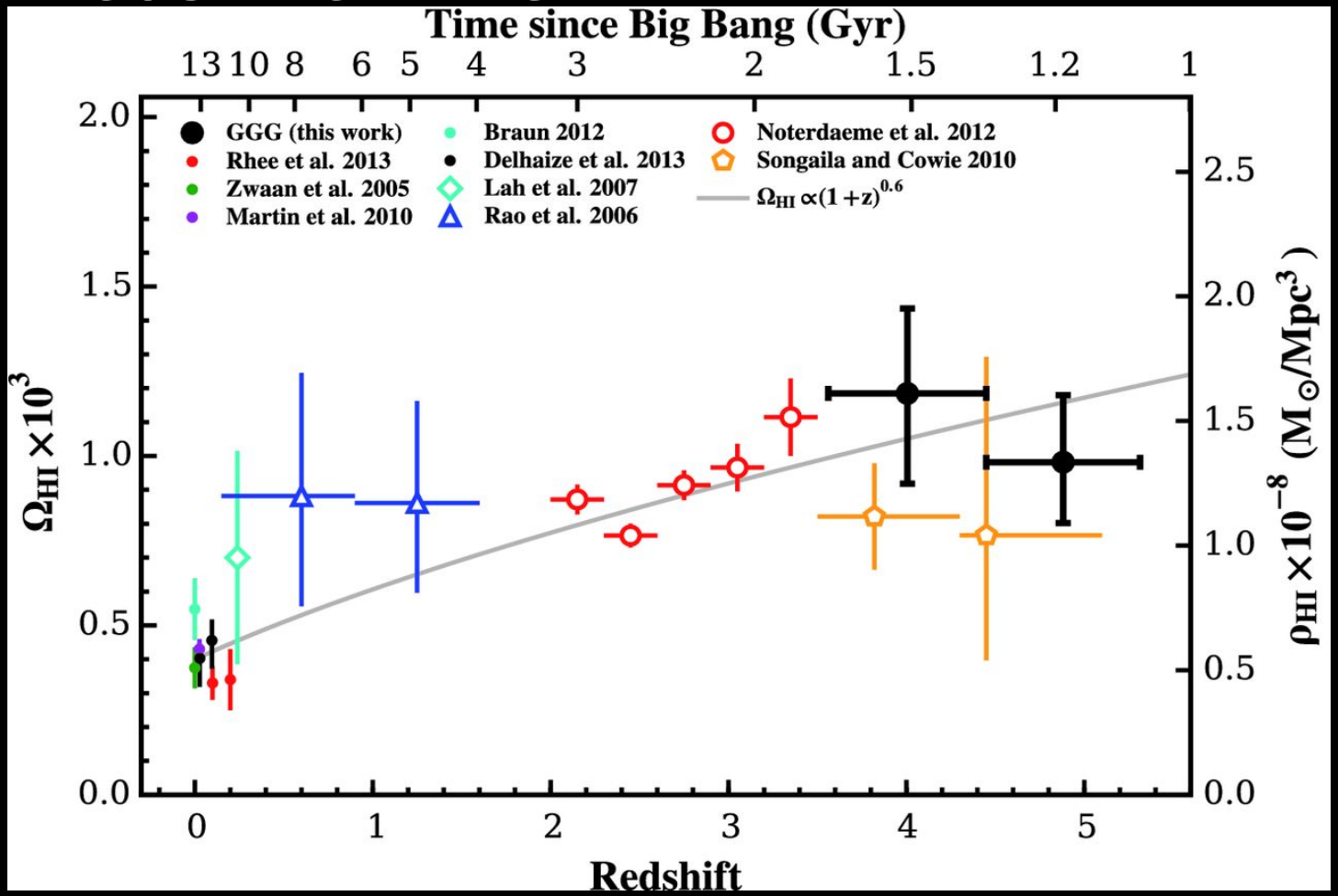


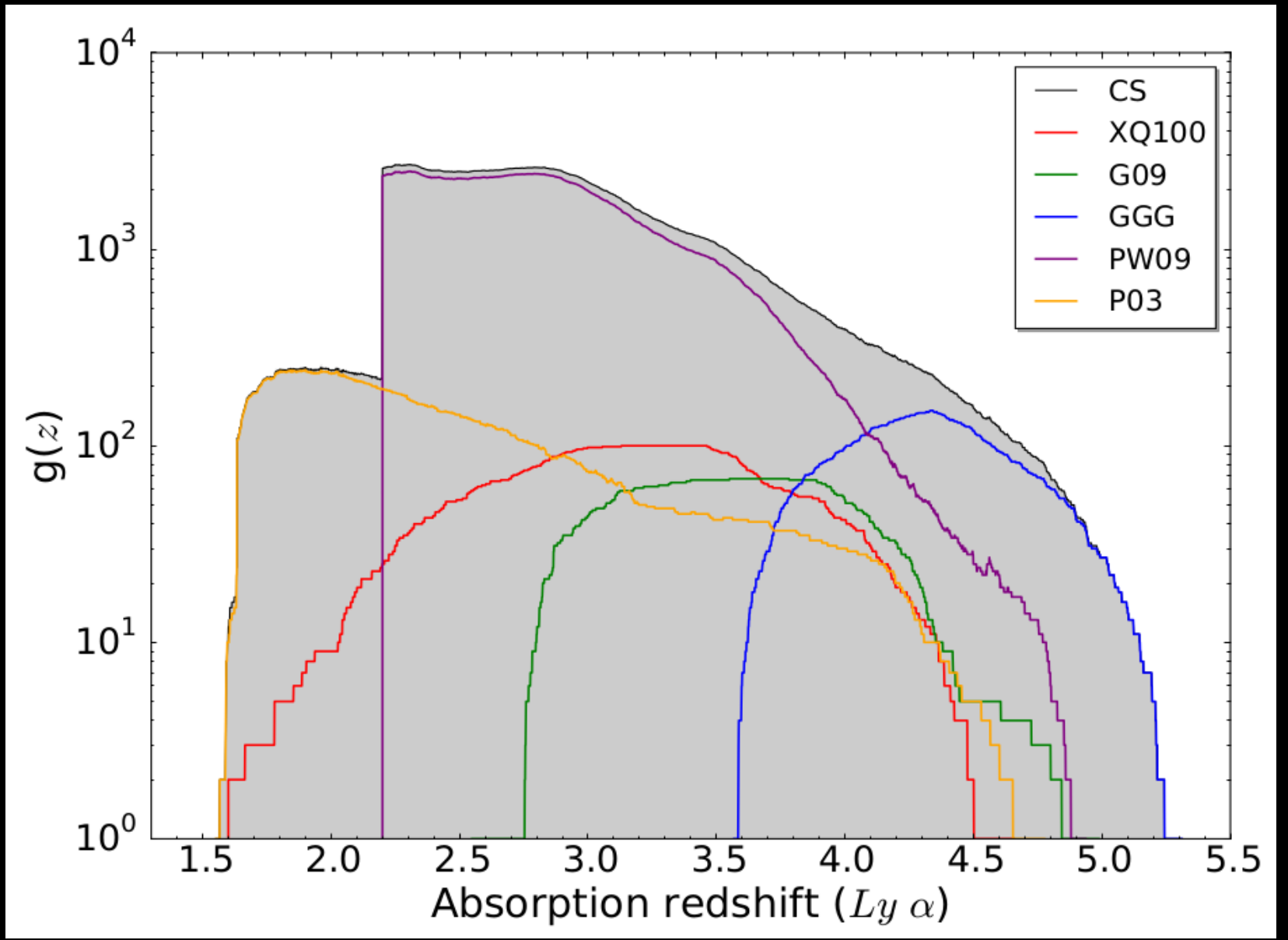
Berg+; in prep.

Ω_{DLA}

- Does the consumption of HI gas change with cosmic time?

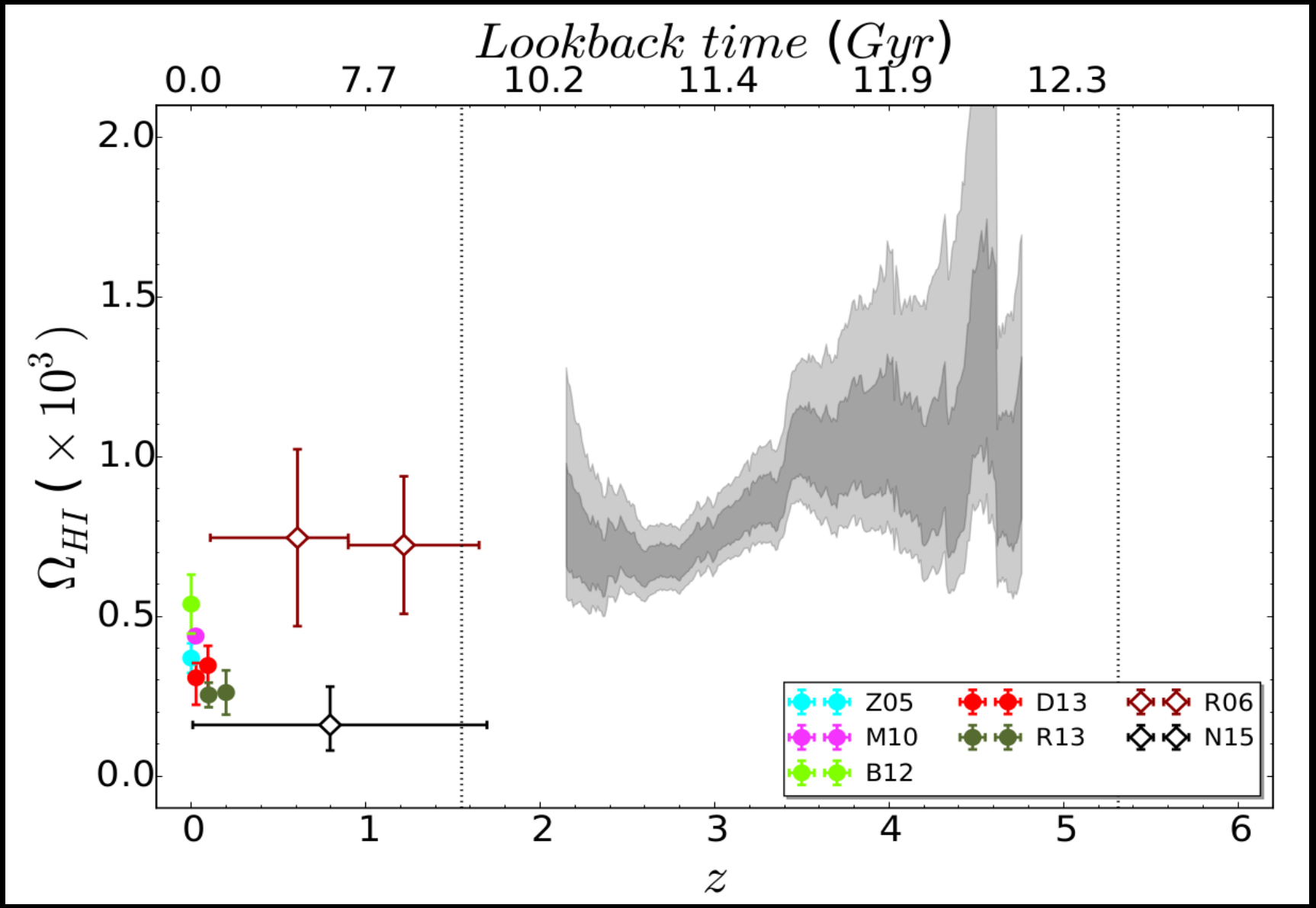


Ω_{DLA}



Sánchez-Ramírez+ (submitted)

Ω_{DLA}



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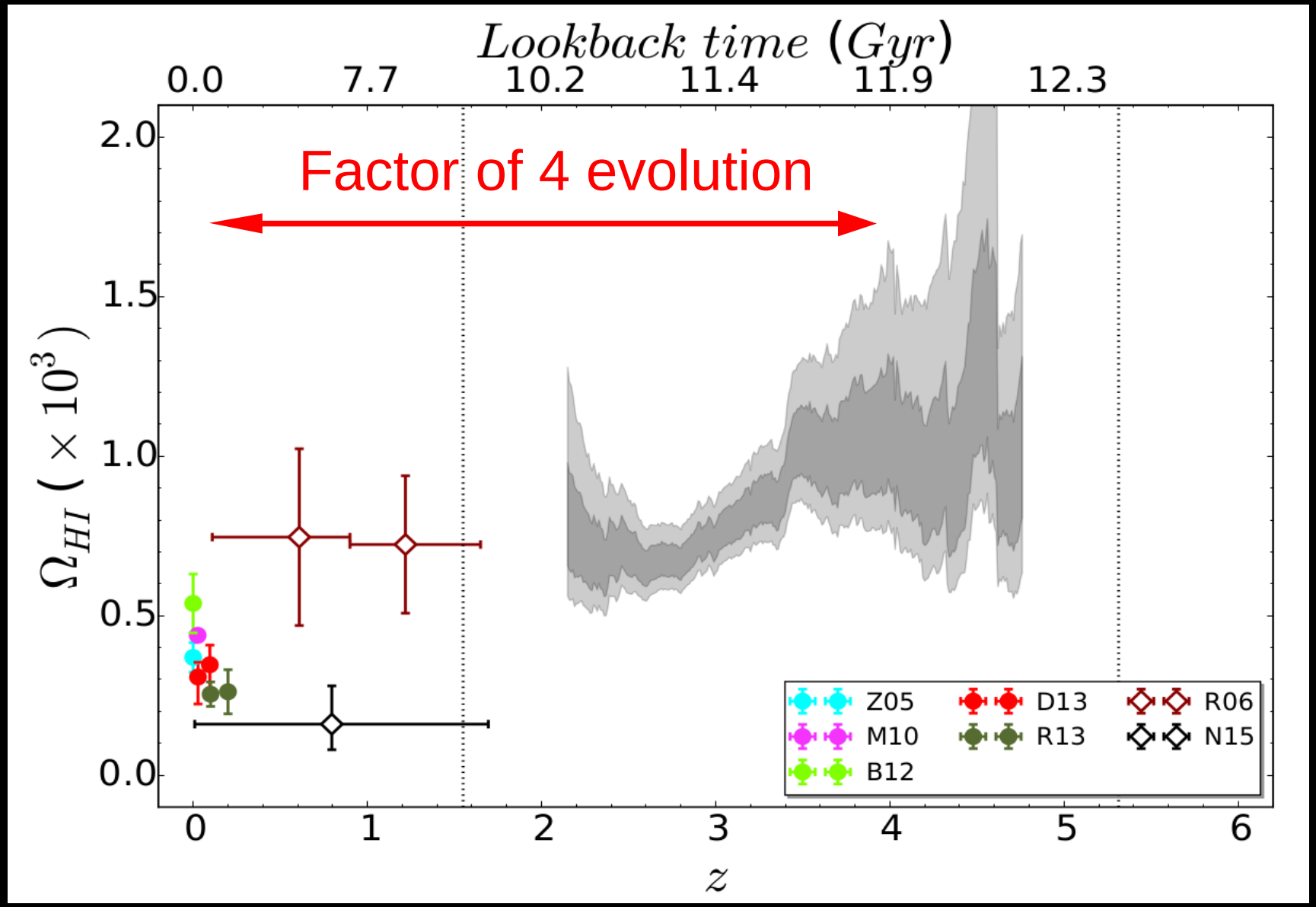
Ω_{DLA}

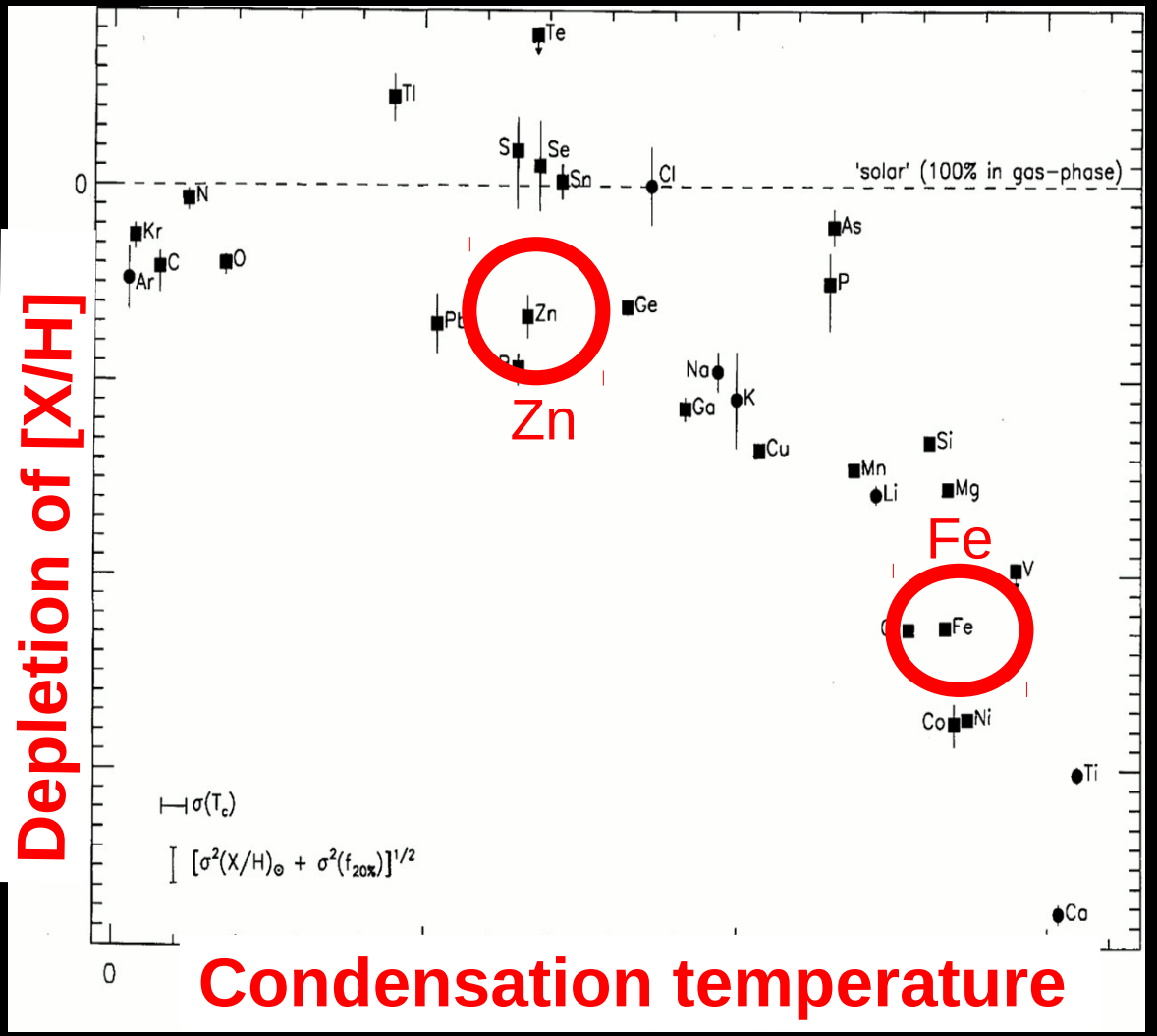


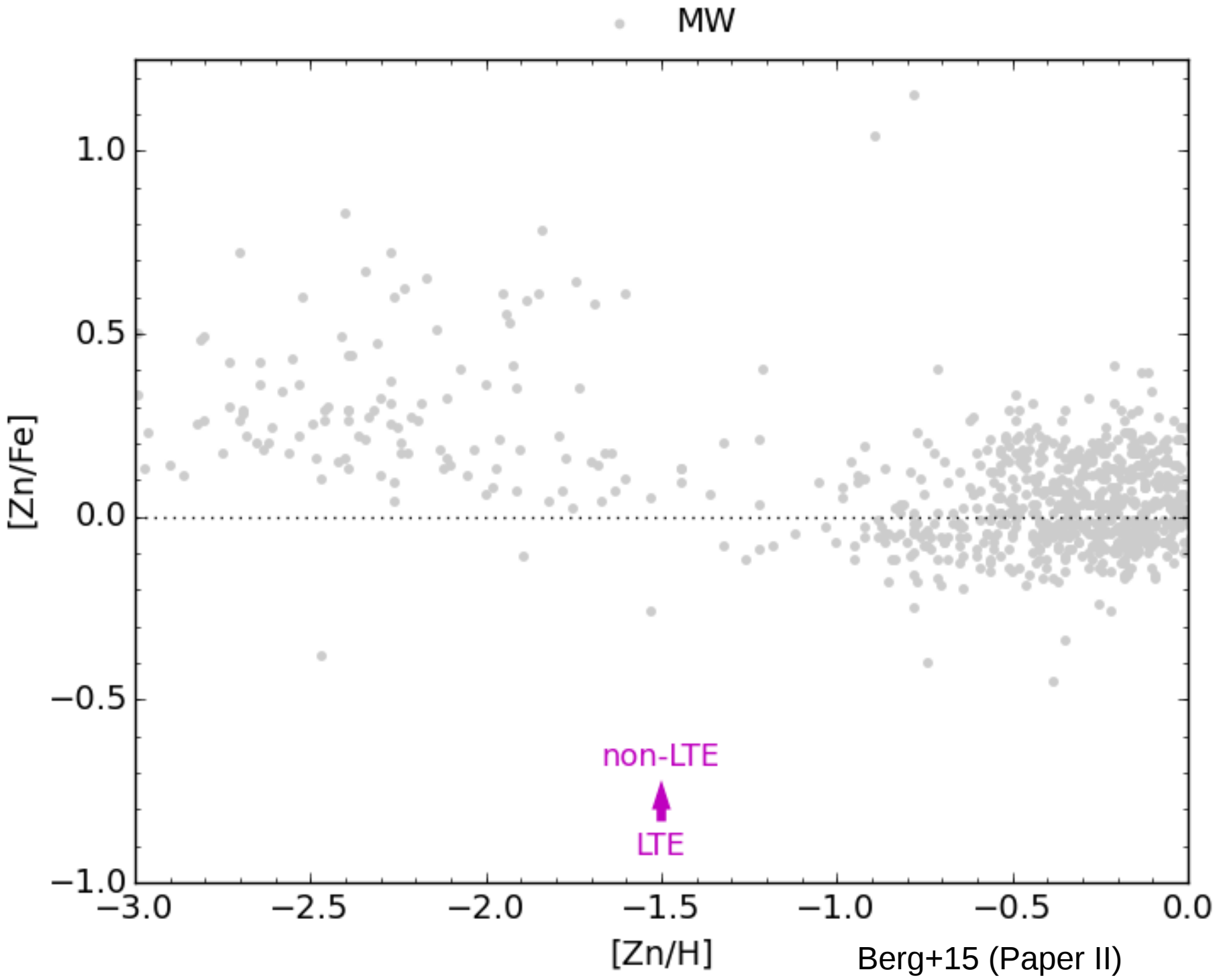
Sánchez-Ramírez+ (submitted)

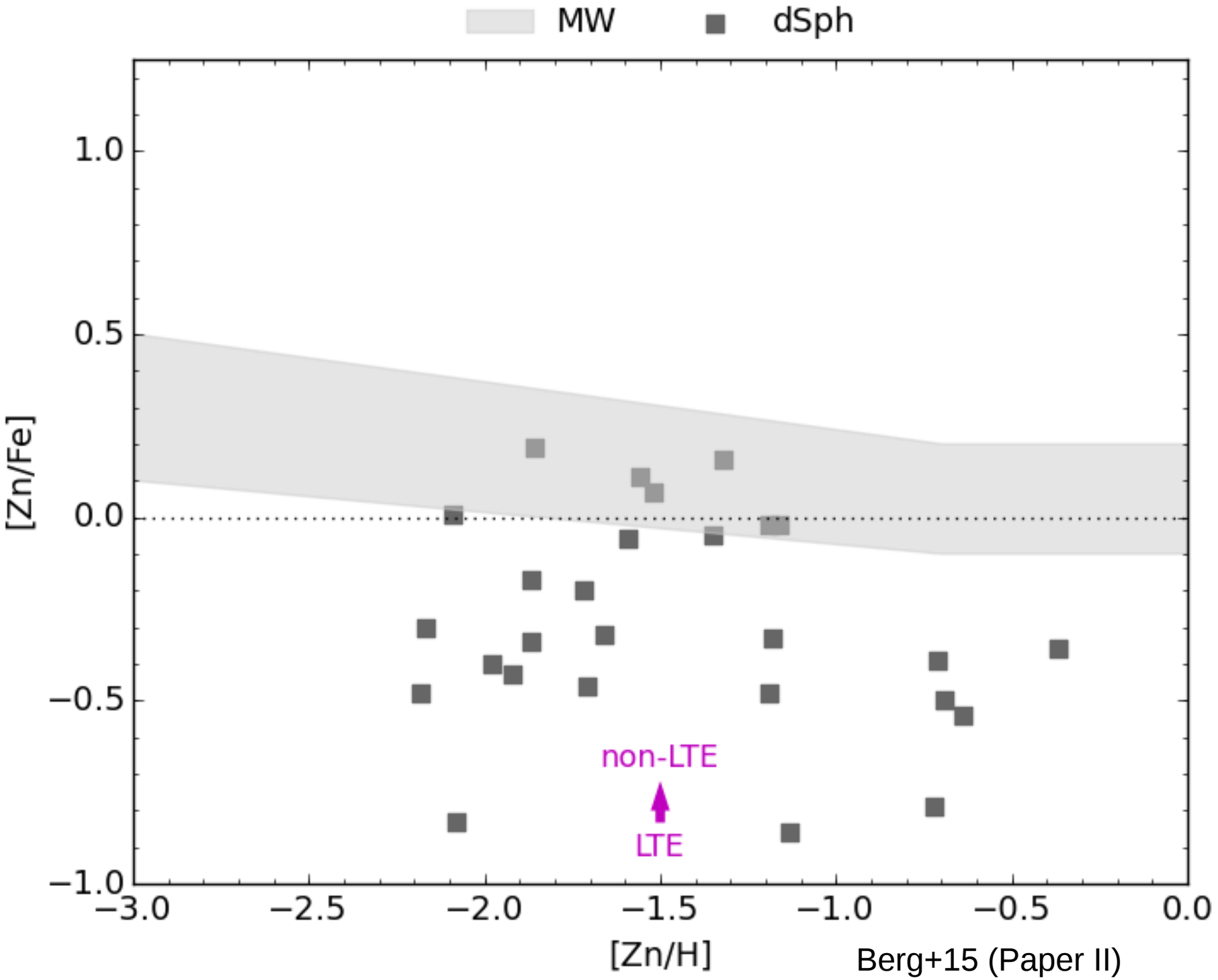
Nucleosynthesis tangles with dust

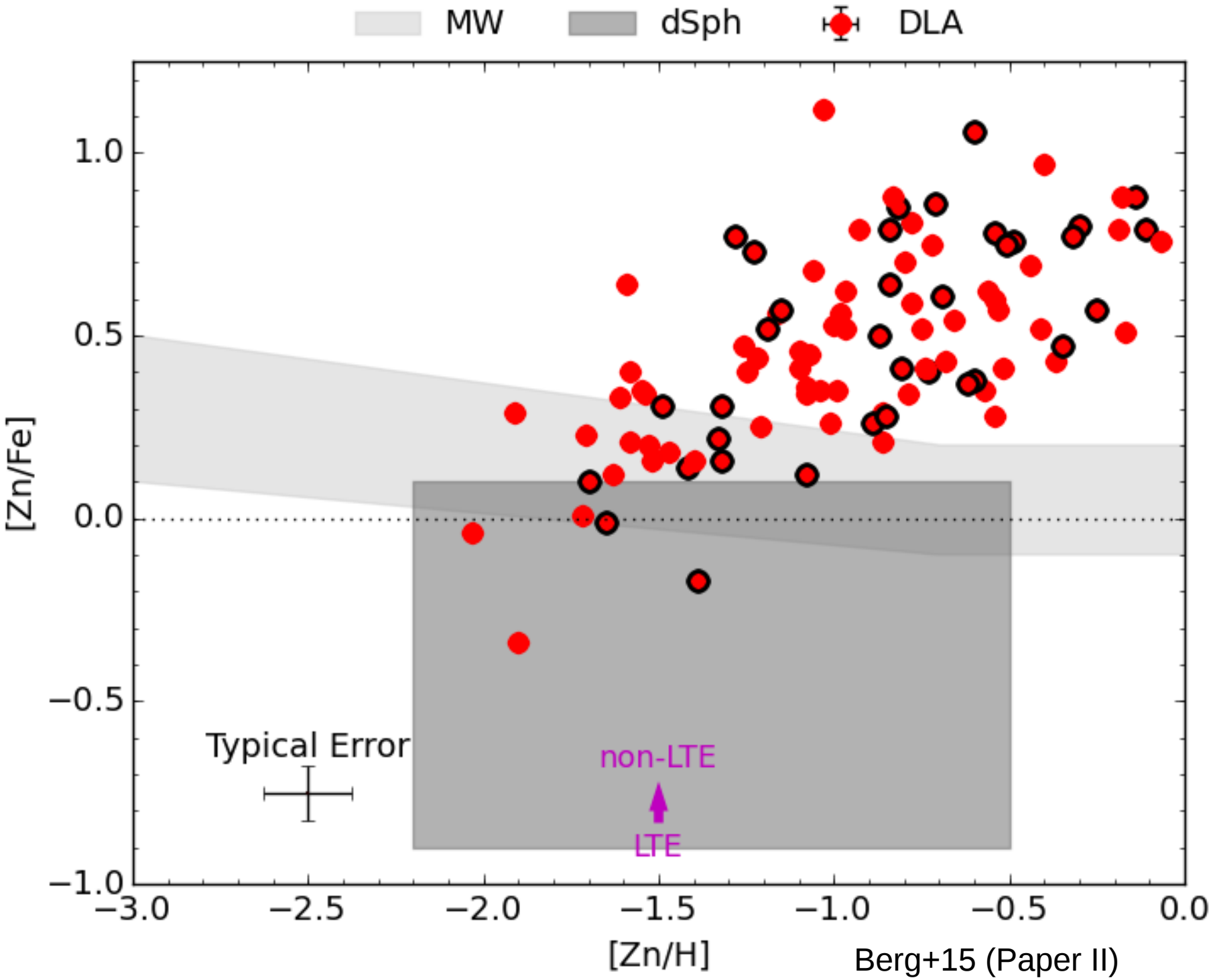
- Nucleosynthesis in DLAs is plagued by dust
- Take [Zn/Fe] for example:
  - Is Zn a dust-free Fe-peak tracer?

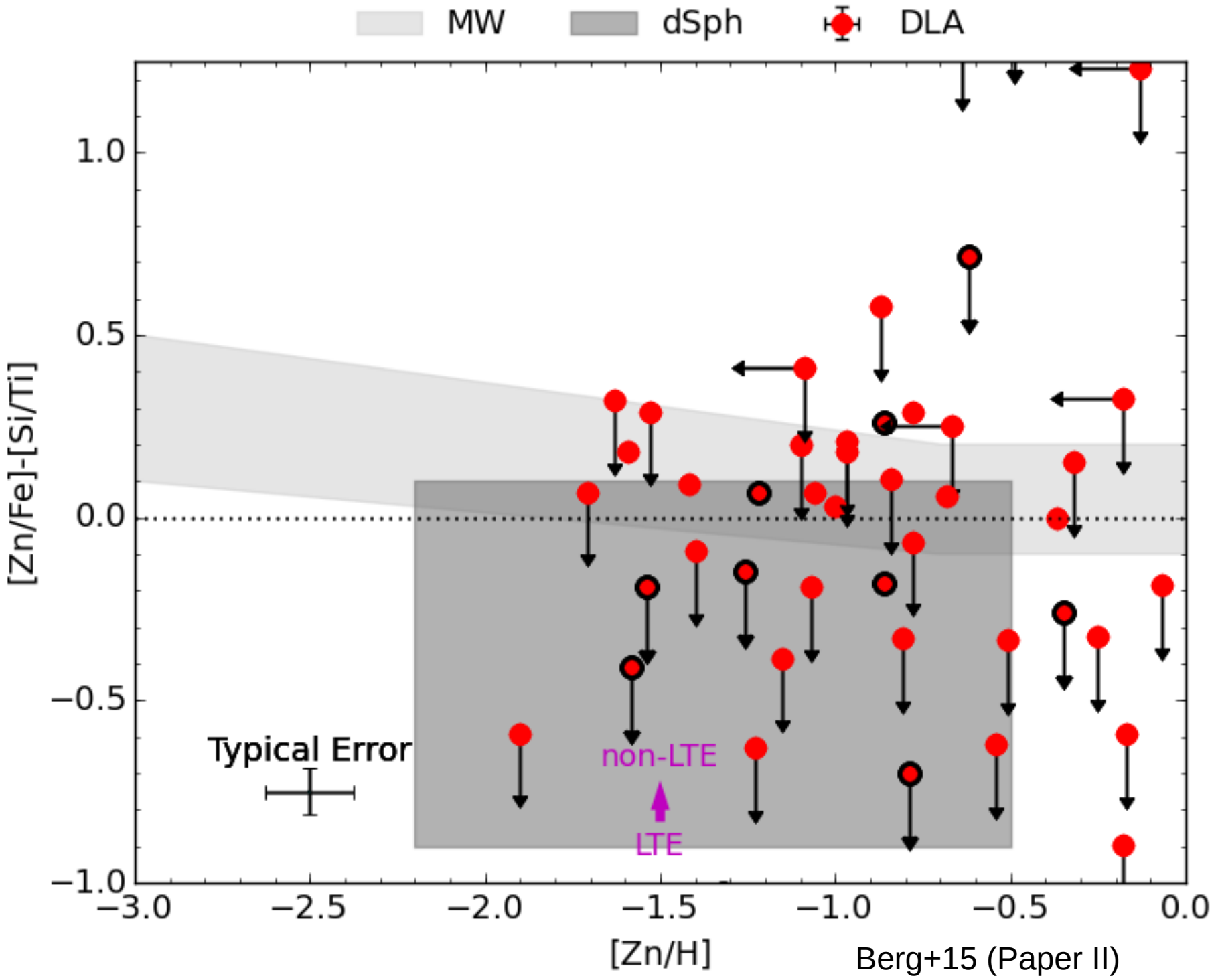
Savage+ (1996)




MW
1.0
0.5
0.0
−0.5
−1.0
[Zn/Fe]
−3.0
−2.5
−2.0
−1.5
−1.0
−0.5
0.0
[Zn/H]
non-LTE
LTE
Berg+15 (Paper II)

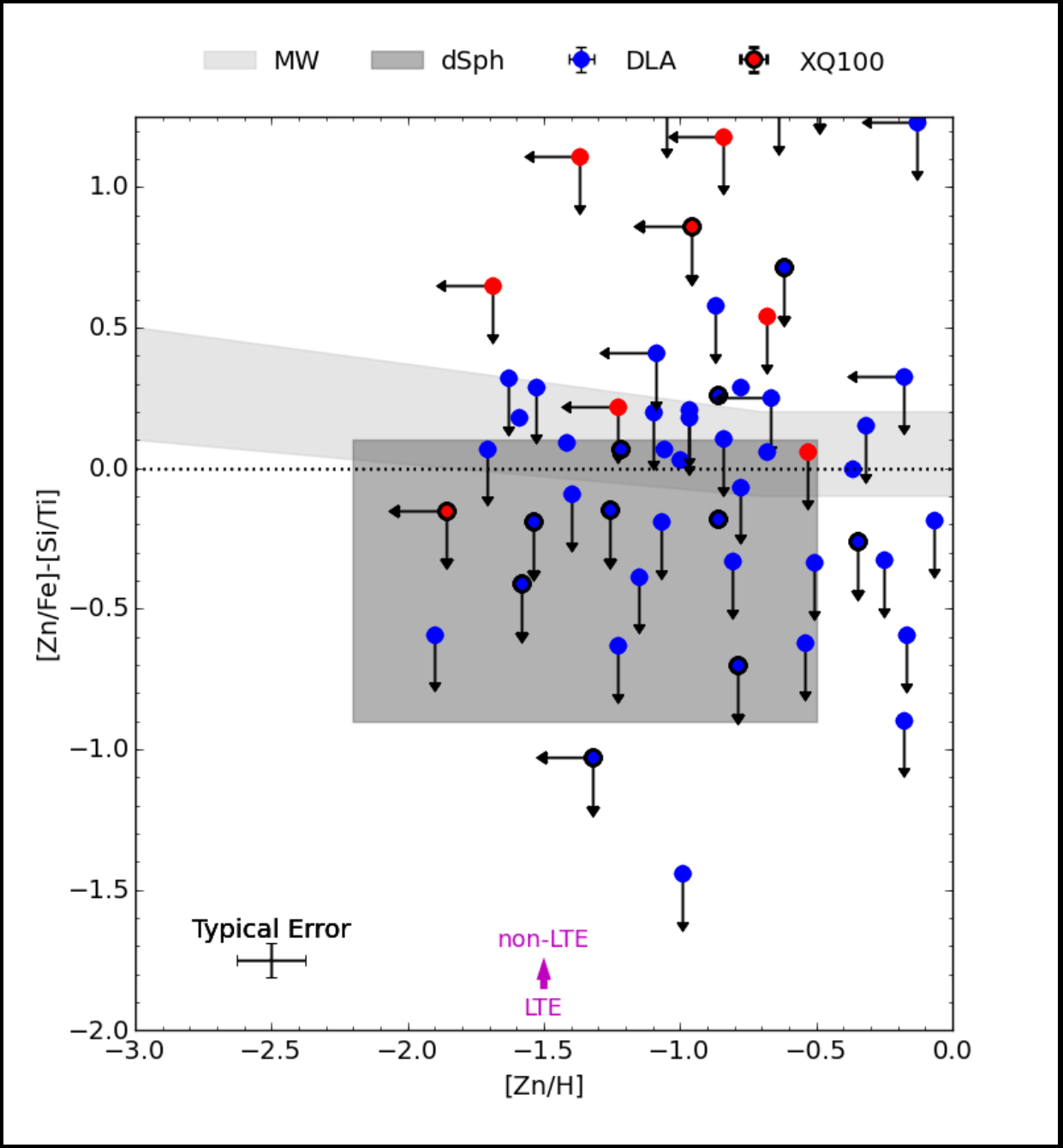

MW
dSph
1.0
0.5
0.0
−0.5
−1.0
[Zn/Fe]
non-LTE
LTE
−3.0
−2.5
−2.0
−1.5
−1.0
−0.5
0.0
[Zn/H]
Berg+15 (Paper II)


MW
dSph
DLA
1.0
0.5
0.0
−0.5
−1.0
[Zn/Fe]
−3.0
−2.5
−2.0
−1.5
−1.0
−0.5
0.0
[Zn/H]
Typical Error
non-LTE
LTE
Berg+15 (Paper II)


MW
dSph
DLA
1.0
0.5
0.0
−0.5
−1.0
[Zn/Fe]-[Si/Ti]
−3.0
−2.5
−2.0
−1.5
−1.0
−0.5
0.0
[Zn/H]
Typical Error
non-LTE
LTE
Berg+15 (Paper II)

Dust corrections Berg+; in prep.

- Red coverage from X-Shooter provides access to Ca, Ti, Mg in XQ-100 DLAs



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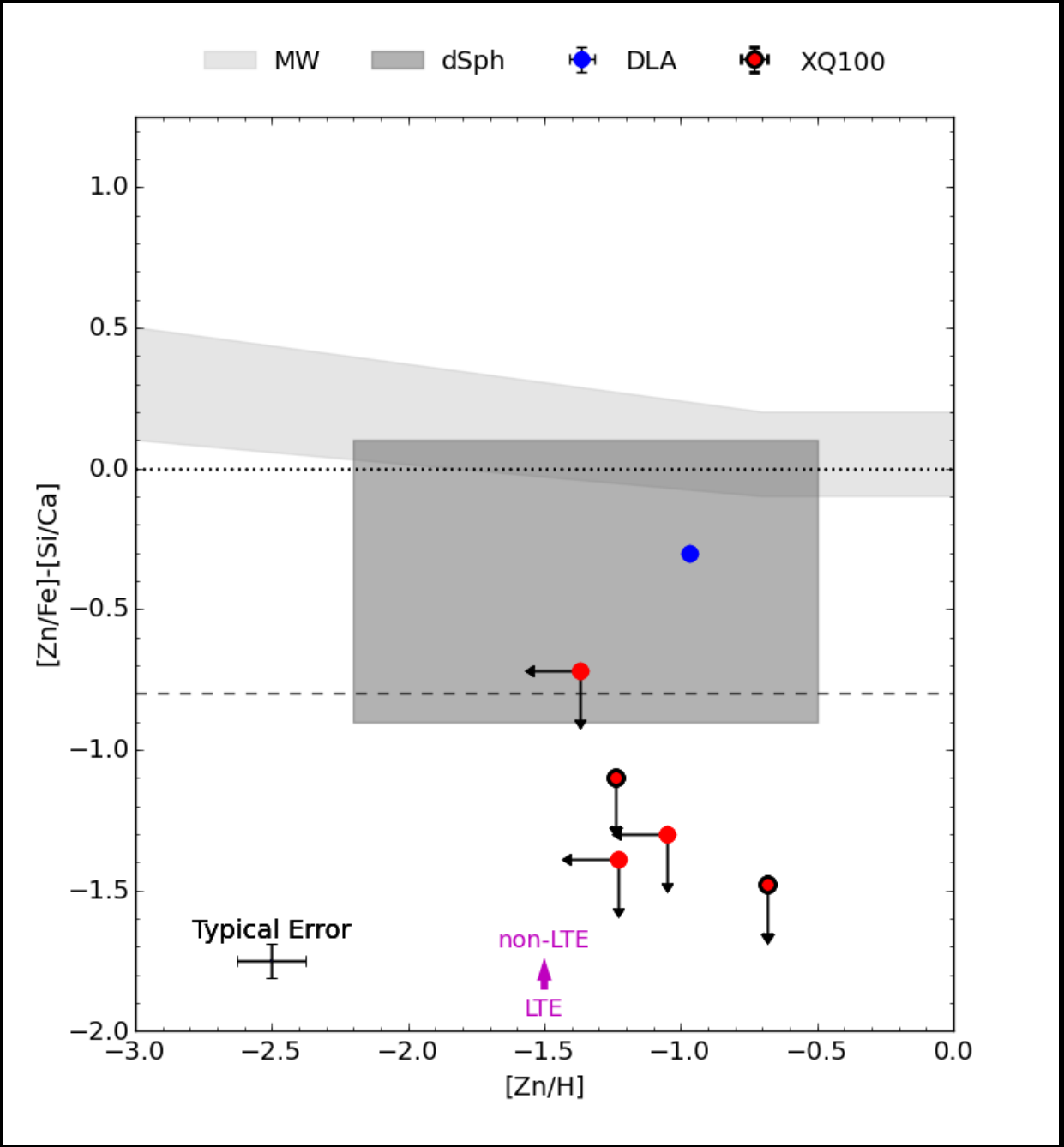

Conclusion

- 38 DLAs with chemical abundances
  - 58 Sub-DLAs to come!
- Novel Ω_{DLA} analysis suggests evolution with redshift (>3σ)
  - Decrease by factor of 4 since z~4
- Zn does NOT (necessarily) trace Fe
  - DLAs consistent with dSph [Zn/Fe]