Tracing Baryons in the Warm Hot Intergalactic Medium using Broad Lyman-α Absorbers

Mid-Term 2

Sameer Patidar
SC19B161

Dual Degree (Astronomy & Astrophysics)
Indian Institute of Space Science and Technology

Supervisors : Dr. Vikram Khaire and Dr. Anand Narayanan

Thesis Phase I : Recap

Recap

- **The missing baryon problem**
- BLAs : Way to probe WHIM
- Absorber towards PG 0003+158
- BLA survey : 28 BLA candidates

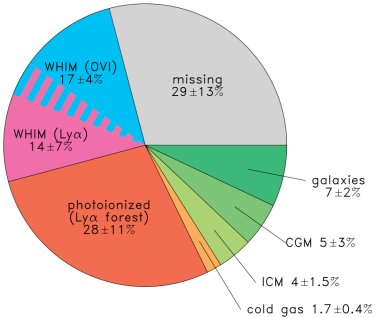

Figure 1: Baryon budget at $z \sim 0$.
Shull et al. (2012)

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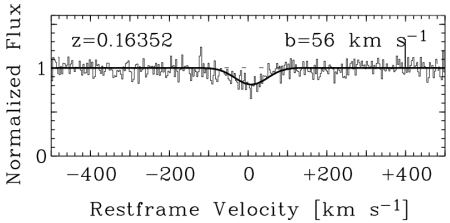

Figure 2: A BLA towards the LOS of quasar H 1821+643. Philipp Richter (2005)

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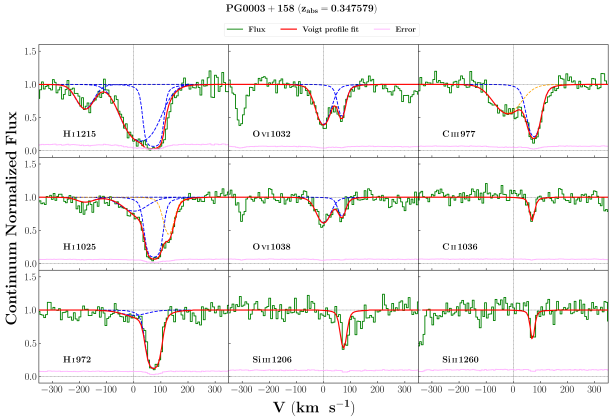

Figure 3: System plot of the absorber system towards PG 0003+158. Velocity is taken zero at z = 0.347579

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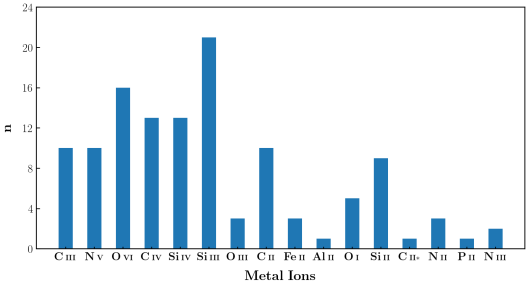

Figure 4: Distribution of metal ions in all 28 candidate BLAs

The BLA Survey

Survey so far...

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- Ionisation Modelling : **16 (O VI)**

Insights

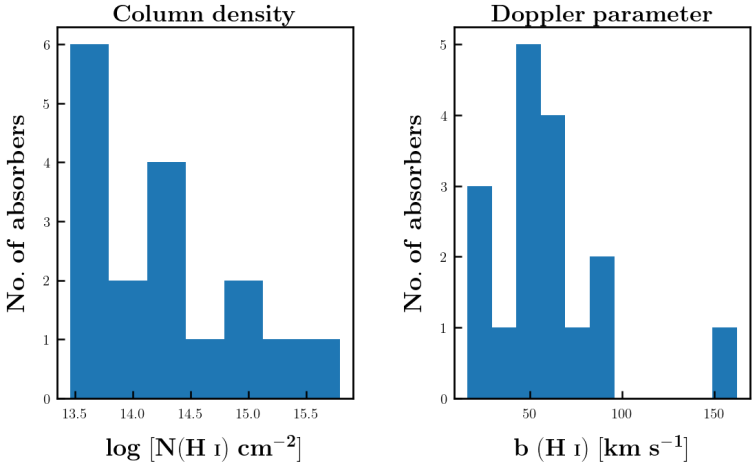

Figure 5: Distribution of H I column densities and Doppler parameters.

Insights

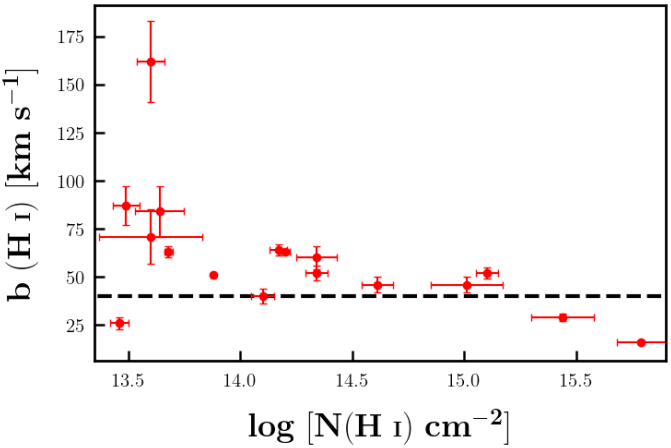

Figure 6: H I column density vs. Doppler parameter

Insights

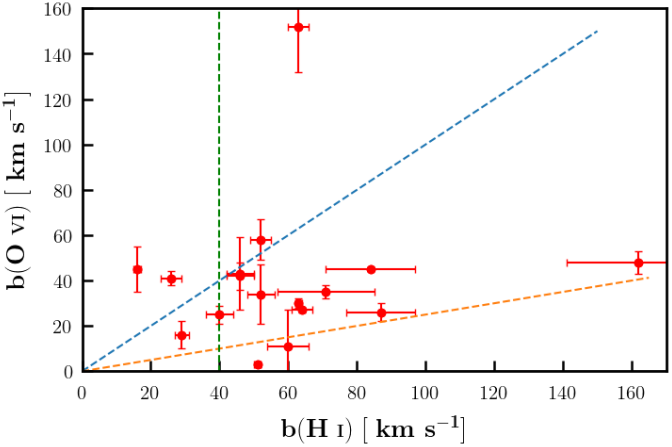

Figure 7: b(O VI) vs. b(H I)

Ionisation Modelling

Method

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- Grid of PI CLOUDY models : Density and Metallicity

Ref. : Acharya and Khaire (2021)

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- Grid of PI CLOUDY models : Density and Metallicity
- log (n_H/cm^{-3}) : -5 to 1 in steps of 0.02
- log $(Z/Z\odot)$: -3 to 2 in steps of 0.05
- Solution : Model that best predicts the observed column densities

Ref. : Acharya and Khaire (2021)

Scaling approximation

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- 2d CLOUDY models : computationally expensive

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- $Z_0 = 0.1 Z\odot$

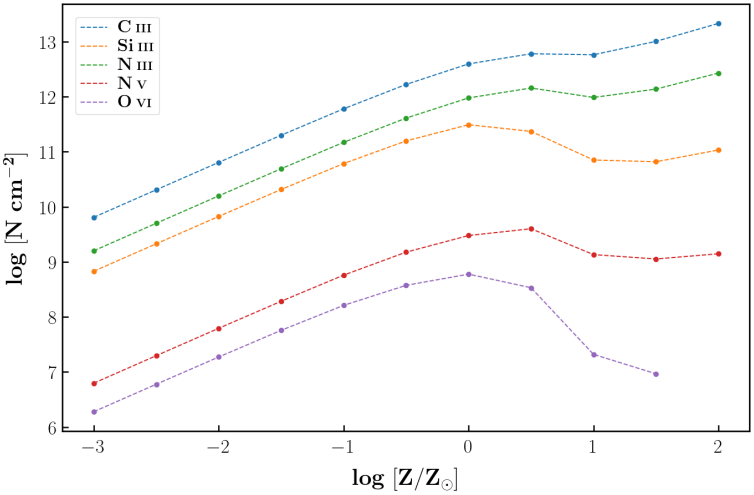

Figure 8: Column densities of various ions at different metallcity. N(H I)=10^{14} cm^{-2} and $n_H = 10^{-3}$ cm^{-3}

Results

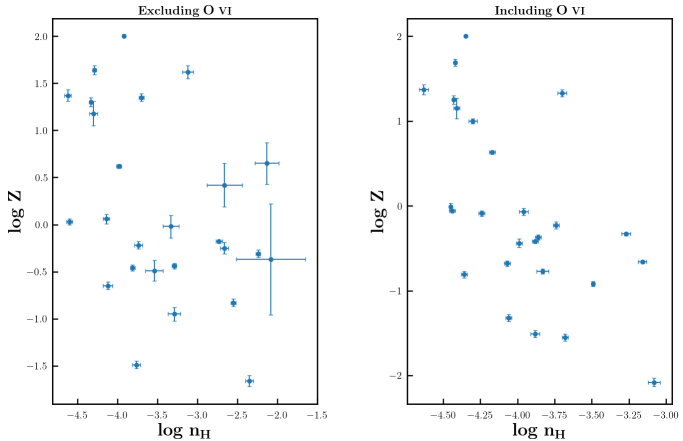

Figure 9: Ionisation modelling solutions for both excluding and including O VI cases.

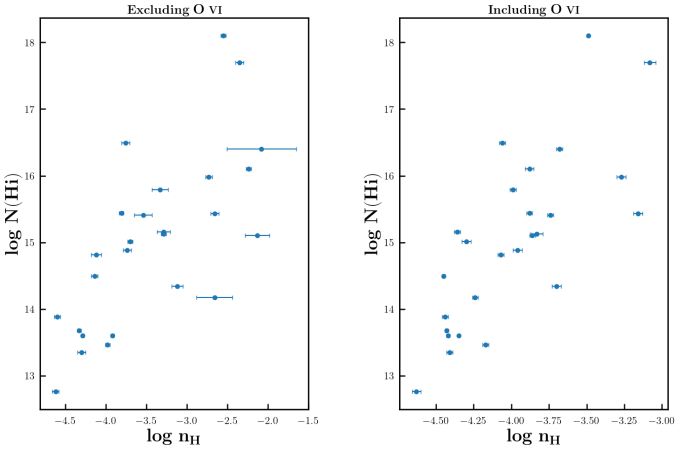

Figure 10: n_H vs. N(H I) for both excluding and including O VI cases.

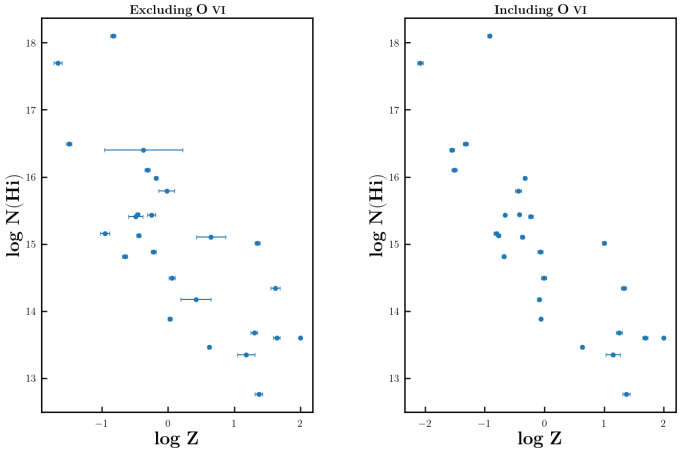

Figure 11: Z vs. N(H I) for both excluding and including O VI cases.

Towards *the end*

Ongoing and Future Work

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- Voigt profile fitting : 6

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- Voigt profile fitting : 6
- Ionisation modelling : 12
- Exploring the survey results
- *Finally*, calculating $\Omega_b(BLA)$

References

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