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

Thesis Phase I

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- $\sim$ 50% baryons were missing
- Recent studies shows deficit of 20-30%

Ref. : Fukugita et al. (1998)
Shull et al. (2012)

Figures/Mid-term/Baryon_distri

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

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Figures/Mid-term/spec slice.png

Figure 2: Slice of spectrum of quasar HE0153-4520 ($z_{em} = 0.4510$). Danforth et al. (2016)

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`Figures/Mid-term/BLA-individual.png`

Figure 3: A BLA towards the LOS of quasar H 1821+643 ($z_{em} = 0.297$) Philipp Richter (2005)

Ref. : Tepper-García et al. (2013)
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Figures/Mid-term/BLA.png

Figure 4: A BLA blended with other Ly α absorption lines towards the LOS of quasar PG1116+215 ($z_{em} = 0.176$). Philipp Richter (2020)

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- R $\sim 17,000 \;\; \approx 17$ km s^{-1}

Phase I

Absorber system towards PG0003+158

Absorber system

- Quasar at $z_{em} = 0.45089$
- $z_{abs} \sim 0.347$
- 3 component system

Figures/Mid-term/Component_structure2.png

Voigt profile fitting

Figures/Mid-term/PG0003+158-z=0.347579-sys-plot.png

Figure 5: System plot of the absorber system. Velocity is taken zero at z = 0.347579

Voigt profile fitting

- H I : 3 components
- O VI : 2 components
- C II, C III, Si II, Si III : 1 component

Figures/Mid-term/param.png

CLOUDY

Figures/Mid-term/cloudy-transparent.png

Figure 6: Schematic diagram of CLOUDY simulations.

Ionization Modelling

- Component I : -
- Component II : Hybrid - Collisional + Photo-ionization
- Component III : Photo-ionization (PI)

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- Grid of CLOUDY models : Density and Metallicity

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- Grid of 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 matches the observed column densities

Ref. : Acharya and Khaire (2021)

Figures/Mid-term/comp-III-PIE.png

Figure 7: Modelled and observed column densities for the component III based on photoionization modelling

Component II : Hybrid

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Figures/Mid-term/b3.png

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- $T = 10^{5.29^{+0.07}_{-0.08}}$ K
- Constant temperature CLOUDY models
- O VI and size as constraining factors

Figures/Mid-term/physical-params.png

The Survey

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- Ionisation modelling :

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28 BLA candidates

Figures/Mid-term/metal-ions.png

Figure 8: No. of different metal ions in all the 28 candidate BLAs

References

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