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

Mid-Term 2

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Thesis Phase I : Recap

Recap

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

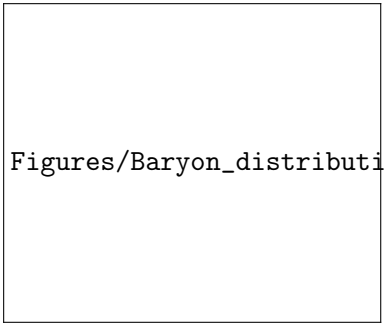

Figure 1: Baryon budget at $z \sim 0$.
Shull et al. (2012)

Ionisation Modelling

Method

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- Grid of PI CLOUDY models : Density and Metallicity

Ref. : Acharya and Khaire (2021)

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- $Z_0 = 0.1 Z\odot$

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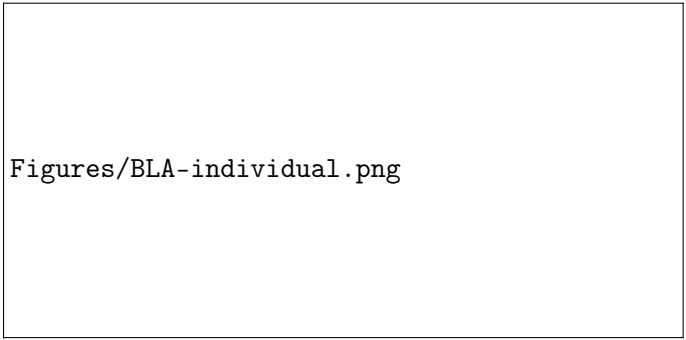

Figure 2: A BLA towards the LOS of quasar H 1821+643 ($z_{em} = 0.297$)
Philipp Richter (2005)

How to detect WHIM ?

- Quasars as backlight
  - O VI-VIII, Ne IX-X, N VII, etc.
  - **BLAs**

Ref. : Tepper-García et al. (2013)
Savage et al. (2014)

Figure 3: A BLA blended with other Lyα absorption lines towards the LOS of quasar PG1116+215 ($z_{em} = 0.176$). Philipp Richter (2020)

Data

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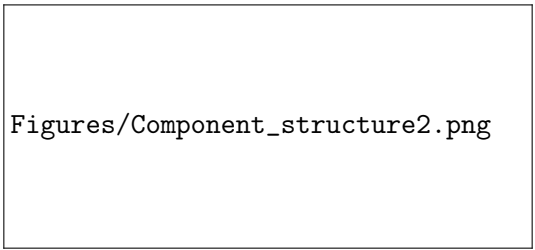
- R $\sim 17,000 \approx 17$ km s^{-1}

Phase I

Absorber system towards PG0003+158

Absorber system

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



Voigt profile fitting

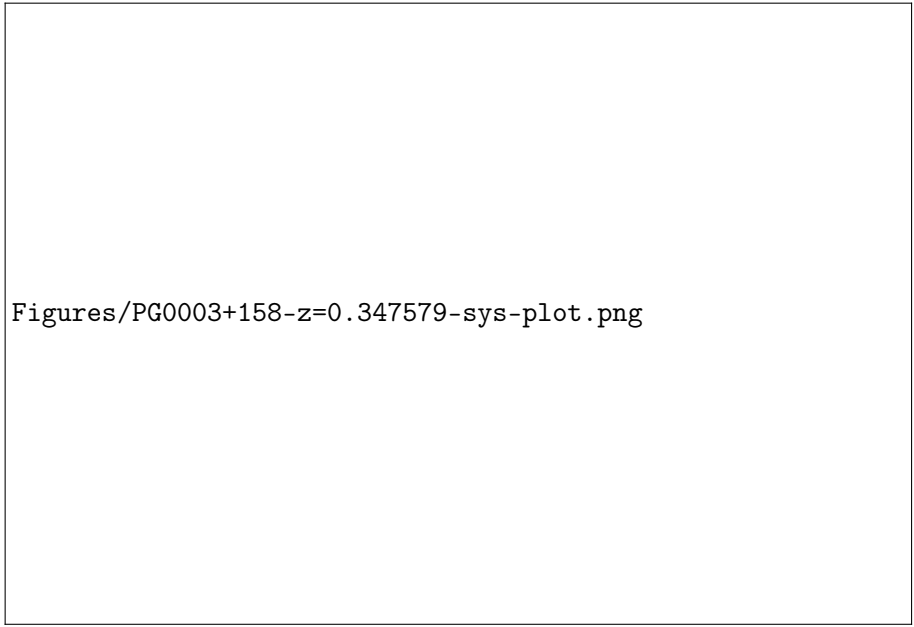
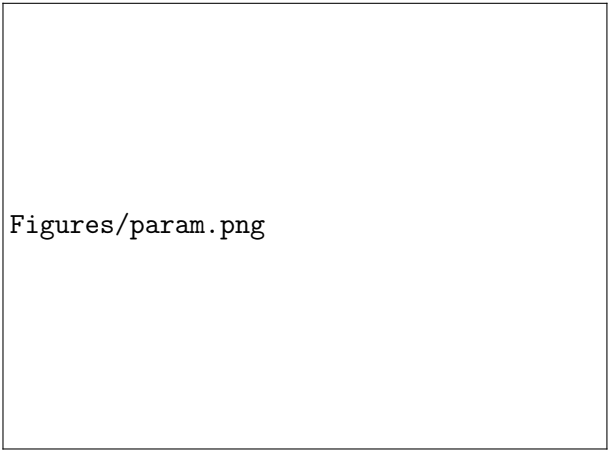


Figure 4: System plot of the absorber system. Velocity is taken zero at z = 0.347579

Voigt profile fitting

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



CLOUDY

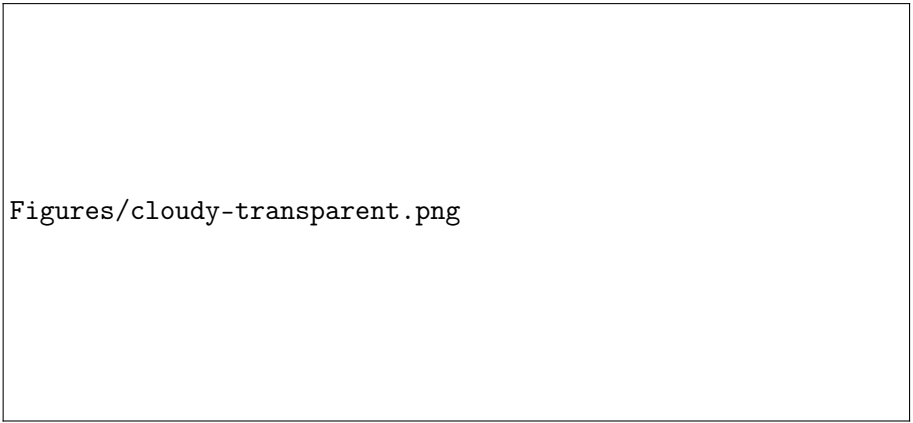


Figure 5: Schematic diagram of CLOUDY simulations.

Ionization Modelling

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

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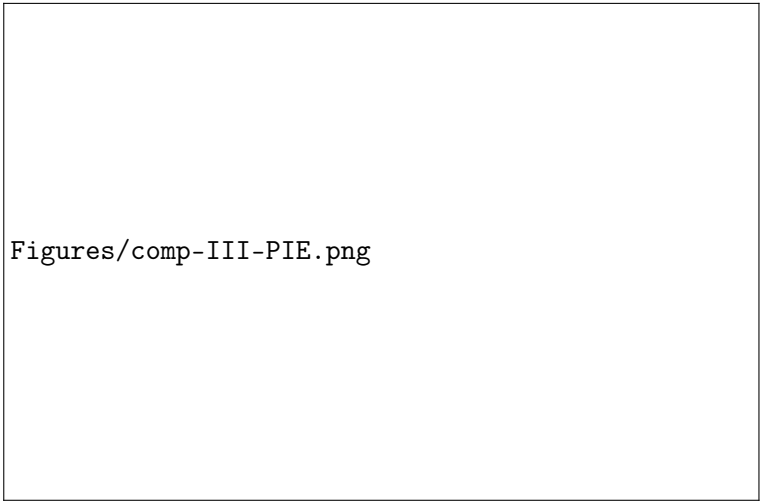

Figure 6: Modelled and observed column densities for the component III based on photoionization modelling

Component II : Hybrid

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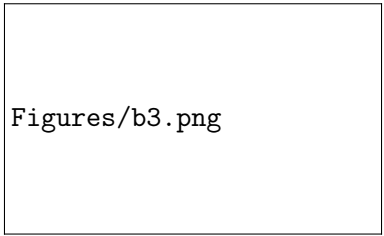

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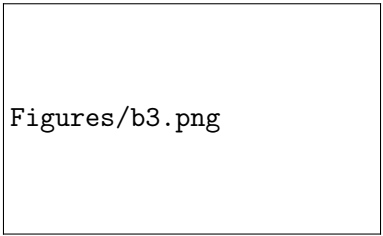

- $T = 10^{5.29^{+0.07}_{-0.08}}$ K

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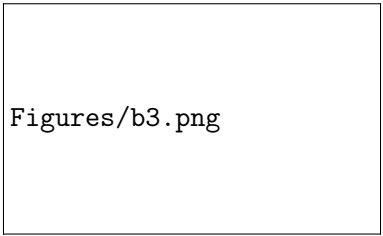

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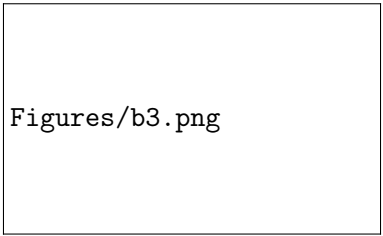

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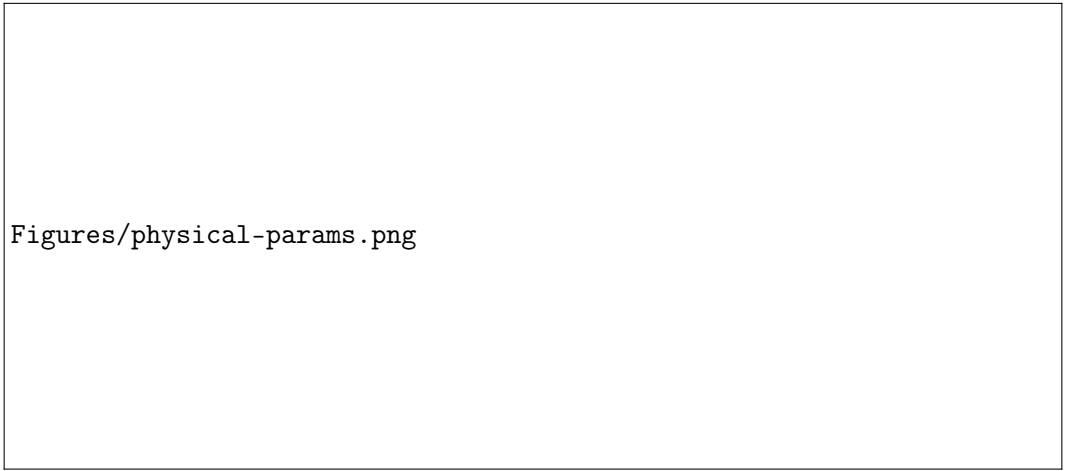
- O VI and size as constraining factors


Figures/physical-params.png

The Survey

Hunt for BLAs

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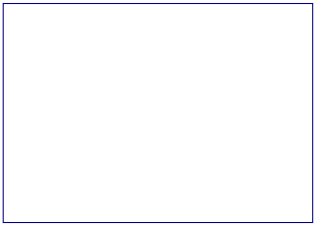

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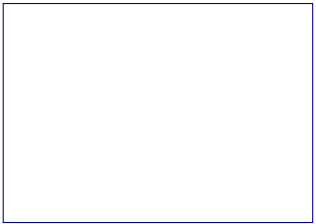

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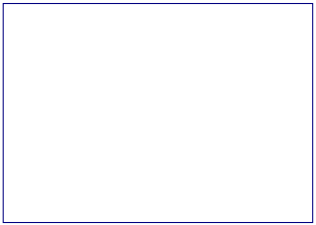

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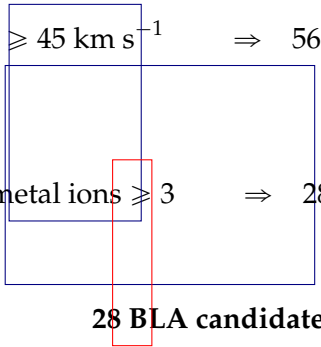

28 BLA candidates

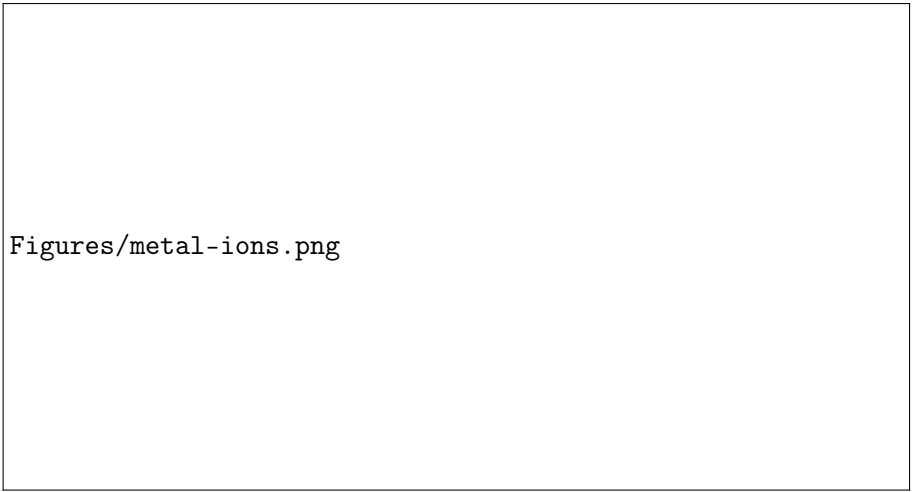

Figure 7: No. of different metal ions in all the 28 candidate BLAs

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