

Searching for OVI Absorption Systems toward PKS1302-102

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Motivating the hunt for OVI absorbers:

The baryonic content of the Universe is well known from Big Bang nucleosynthesis models, deuterium abundances, and the high-redshift Lyman- α forest: $\Omega_b = 0.02$. However, surveys of the nearby Universe reveal a dearth of baryons in stars, galaxies, and clusters (see Table 1). Recent cosmological simulations have placed the most likely reservoir of baryons at low redshift—upward of 40%—in moderately overdense $\delta \sim 10$ -30, collisionally ionized gas, called the **warm-hot intergalactic medium**. With temperatures in the range 10^{5-7} K, the WHIM proves tricky to observe. The most reasonable tracer is the **OVI doublet** $\lambda\lambda 1032, 1038 \text{ \AA}$, which dominates at $\sim 3 \cdot 10^5$ K under collision ionization equilibrium (see Figure 1).

Table 1

LOCAL BARYON BUDGET		
Component	Fraction	Percentage
Stars	0.0035	17%
Gas	0.00063	3%
"Plasma"	0.017	81% ← WHIM

Theory vs. Observation:

The simulations predict that the majority of the baryons in the WHIM reside in **filaments**. The collapsing structure shock heats the medium to the WHIM temperature range. However, of the handful of studies of low-redshift OVI absorbers, several systems appear to be **associated with galaxies**.

In addition, theory holds that the WHIM is **collisionally ionized** but the observed OVI absorption systems seem best described by **photoionization or a multi-phase medium**.

References:

- Fang, T., & Bryan, G. L. 2001, *ApJ*, 561, L31
- Fukugita, M., Hogan, C. J., & Peebles, P. J. E. 1998, *ApJ*, 503, 518
- Prochaska et al. 2004, *ArXiv Astrophysics e-prints*

Table 2

PKS1302-102 SUMMARY	
z_{em}	0.286
OBSERVATIONS	
HST/STIS E140M	22 ks
FUSE	149 ks
GALAXY SURVEY	
R_{lim}	19.5
5' Completeness	89%

Current work:

This project strives to characterize OVI absorption systems by identifying and measuring absorption features in the far-ultraviolet spectra of the low-redshift quasar PKS1302-102, modeling possible ionization schemes, and studying the correlation of the systems with galaxies.

OVI absorption system at $z_{\text{abs}} = 0.1916$:

With an equivalent width of $52 \pm 18 \text{ m\AA}$, the stronger OVI $\lambda 1032$ is only a **2.8 σ** detection, and OVI $\lambda 1038$ is only a 1.2 σ detection. However, six Lyman lines and CIII $\lambda 977$ are found at the same wavelength (see Figure 2).

The FUV spectra are supported by a galaxy survey of the field surrounding PKS1302-102, made at Las Campanas Observatory. The closest galaxy in the PKS1302-102 field is at $z_{\text{abs}} = 0.19238$ and has an impact parameter **305 $h^{-1} \text{ kpc}$** .

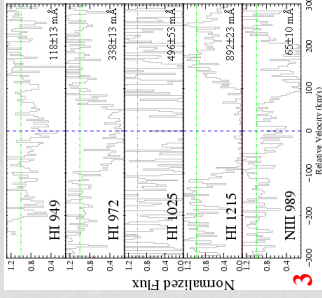
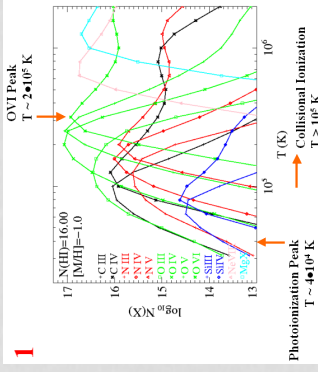
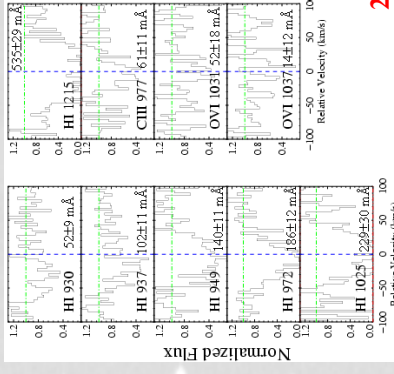
BONUS—Partial Lyman Limit System:

A partial Lyman Limit System was discovered at $z_{\text{abs}} = 0.1453$. It has a galaxy at the same redshift and an impact parameter **57 $h^{-1} \text{ kpc}$** . At least one metal line, NIII $\lambda 989$, was detected (see Figure 3).

Conclusions and future work:

Presented here are only the **preliminary results** from the study of the PKS1302-102 sightline. **More absorption features** have yet to be identified and analyzed.

In addition, the analysis presented here will be applied to **several other low-redshift quasar spectra**. Only a handful of sight lines to low-redshift quasars have been studied to date, and none have the quality galaxy survey that complements this study. Hopefully, this data set will help characterize the nature of the OVI absorption systems and the WHIM in general



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Background: DSS image of PKS1302-102 (15' x 20')