Probing the circumgalactic medium of galaxies at z~0.4

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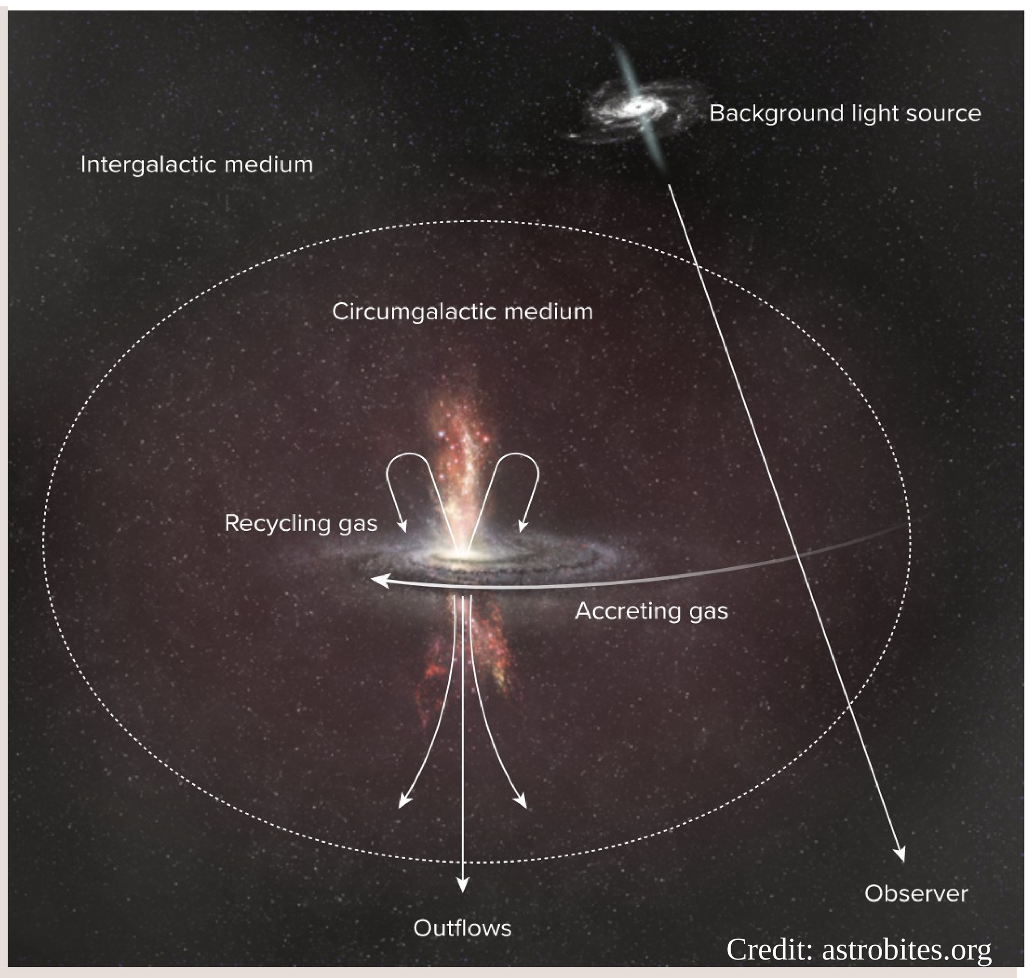
INTRODUCTION

Circumgalactic medium (CGM) is the diffuse gas surrounding galaxies outside their luminous regions, but within the virial radii. It is present where we expect to find:

- Metal poor gas accreted from the neighbouring intergalactic medium.
- Metal rich gas ejected from starburst driven winds and AGN activity.
- Interstellar gas displaced from dwarf satellite galaxies via tidal stripping.

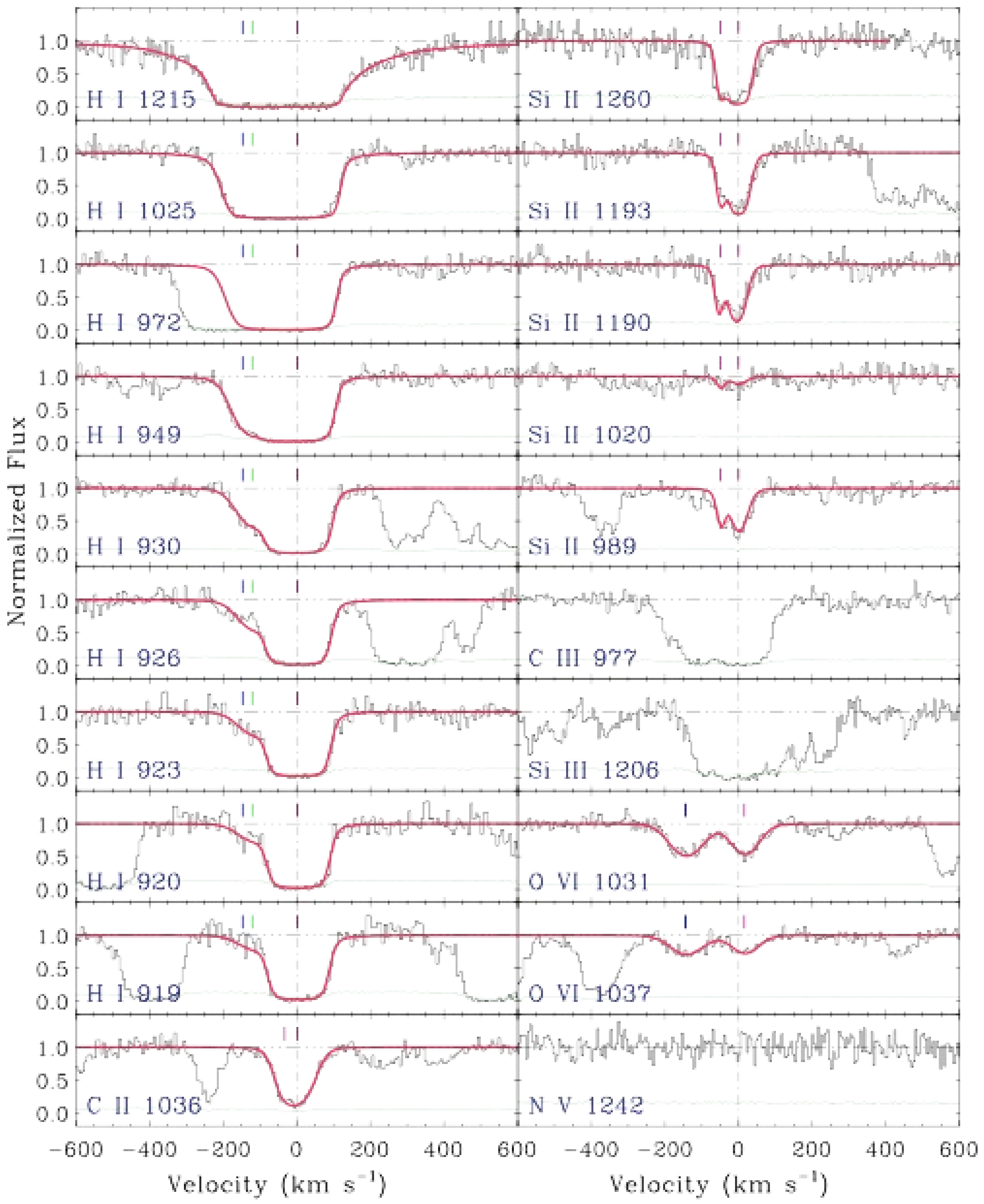


Credit: astrobites.org

- CGM contains as much baryons as the discs of galaxies.
- Studying the physical properties of CGM is important to understand these galactic scale processes.

LINE FITTING

- We observe the HST/COS UV spectrum of a background quasar and observe absorption lines as a result of an absorber system at a redshift of around 0.4.
- The absorber has a high neutral hydrogen column density (>10^{18} cm^{-2}), suggesting that it might be associated with a galaxy.
- We use VPFIT to fit voigt profiles to the detected absorption lines and compute the parameters like column density of the species, Doppler-b parameter and velocity centroid of the lines.

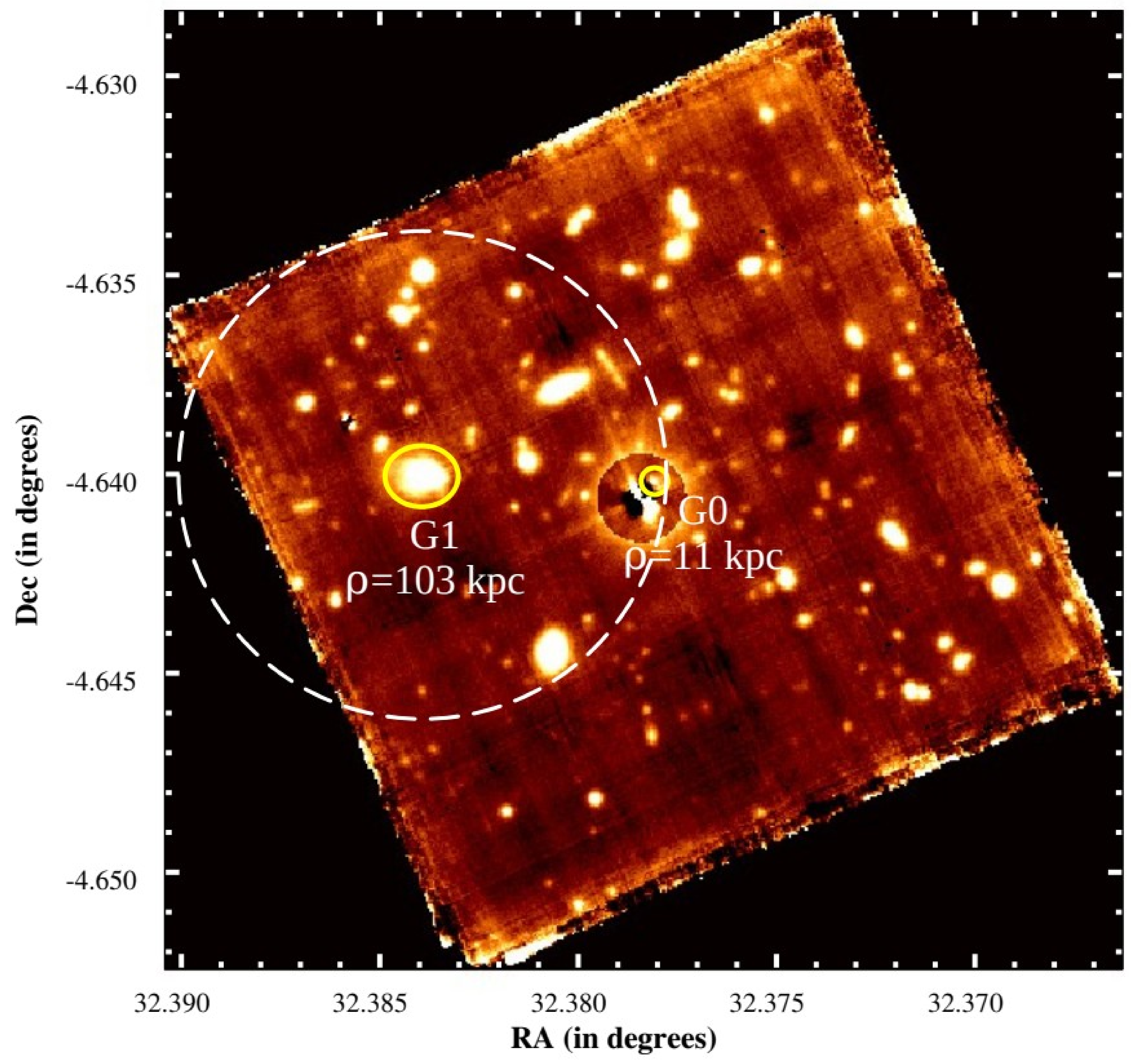


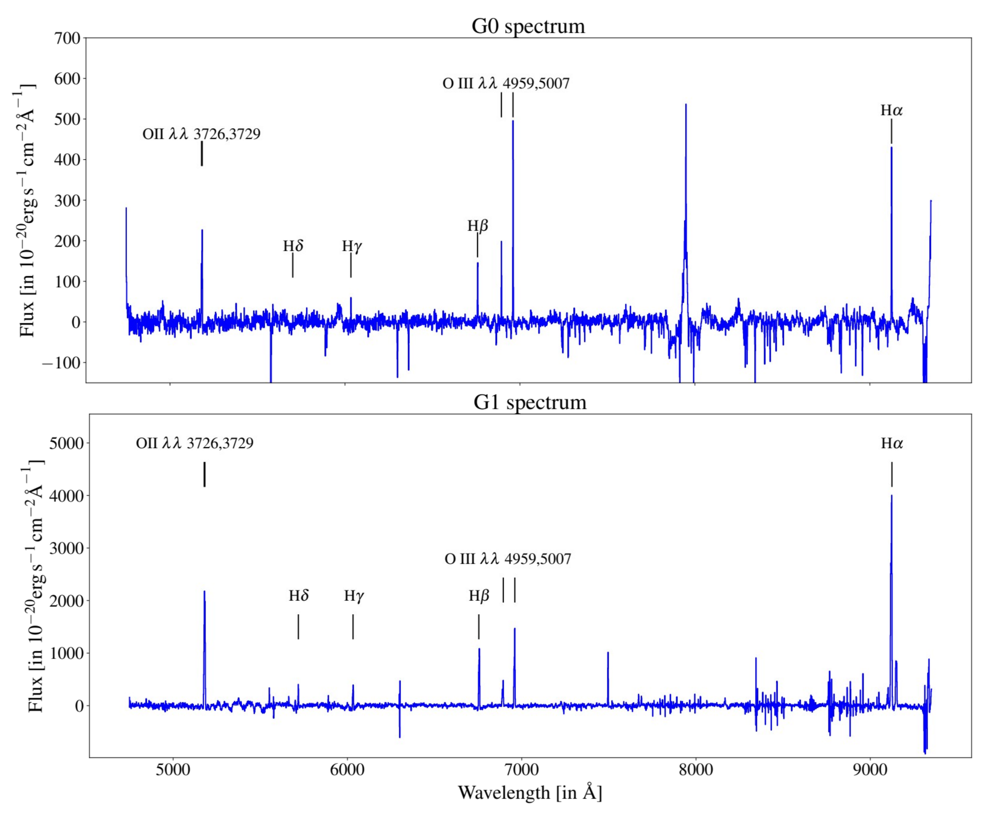
IONIZATION MODELING

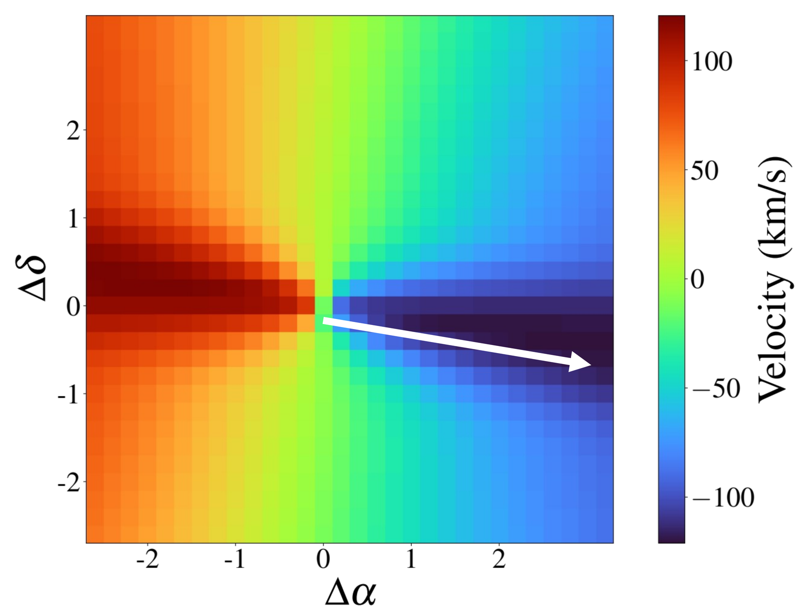
Phase	Comp 1 (sub-DLA)	Comp 2	Comp 3 (BLA)
Constraing Ions	C II, Si II, N III	C III, O VI	O VI
v (km/s)	-2	-121	-147
T (in K)	1.35×10^4	1.35×10^4	1.46×10^6
L (in kpc)	5.755	25.28	-
nH (in cm^{-3})	4.07×10^{-3}	2.09×10^{-4}	-
$\log (Z/Z_\odot)$	-0.67 ± 0.07	0	0
N(H I) (in cm^{-2})	4.47×10^{18}	7.24×10^{15}	1.02×10^{14}
N(H) (in cm^{-2})	7.23×10^{19}	1.63×10^{19}	7.33×10^{20}

- Using photoionization and collisional ionization models, we constrain the density, ionization equilibrium temperature, and metallicity in the different gas phases of the absorber.
- The absorber has two prominent gas phases: a photoionized cooler gas phases traced by the sub-DLA and low ionization metal lines, and a million Kelvin warmer highly ionized gas phase seen via O VI and thermally broad hydrogen absorption component. The warmer gas phases contains as much baryons as the sub-DLA phase.

VLT/MUSE IFU DATA ANALYSIS







The velocity field map for G1, obtained by GalPaK 3D analysis. The white arrow indicates the points to the location of the quasar.

CONCLUSIONS

Using a combination of HST/COS absorption line spectroscopic data in the far-UV and integral field unit data from the VLT/MUSE, we have completed the analysis of circumgalactic gas in the merged halos of two z ~ 0.4 galaxy. The absorption shows the presence of a mixture of cold and warm kinematically overlapping gas phases traced by a Lyman limit system and a broad Lyman-alpha absorption, respectively. The metallicity we derive for the absorbing gas, as well as the orientation of the quasar line of sight with the galaxies favour the origin of the absorption as metal-enriched gas displaced from one of the galaxies in possibly supernova driven feedbacks from star formation.

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