

GALAXIES IN SILHOUETTE

Using Mg II Absorption to Study the
Circumgalactic Medium

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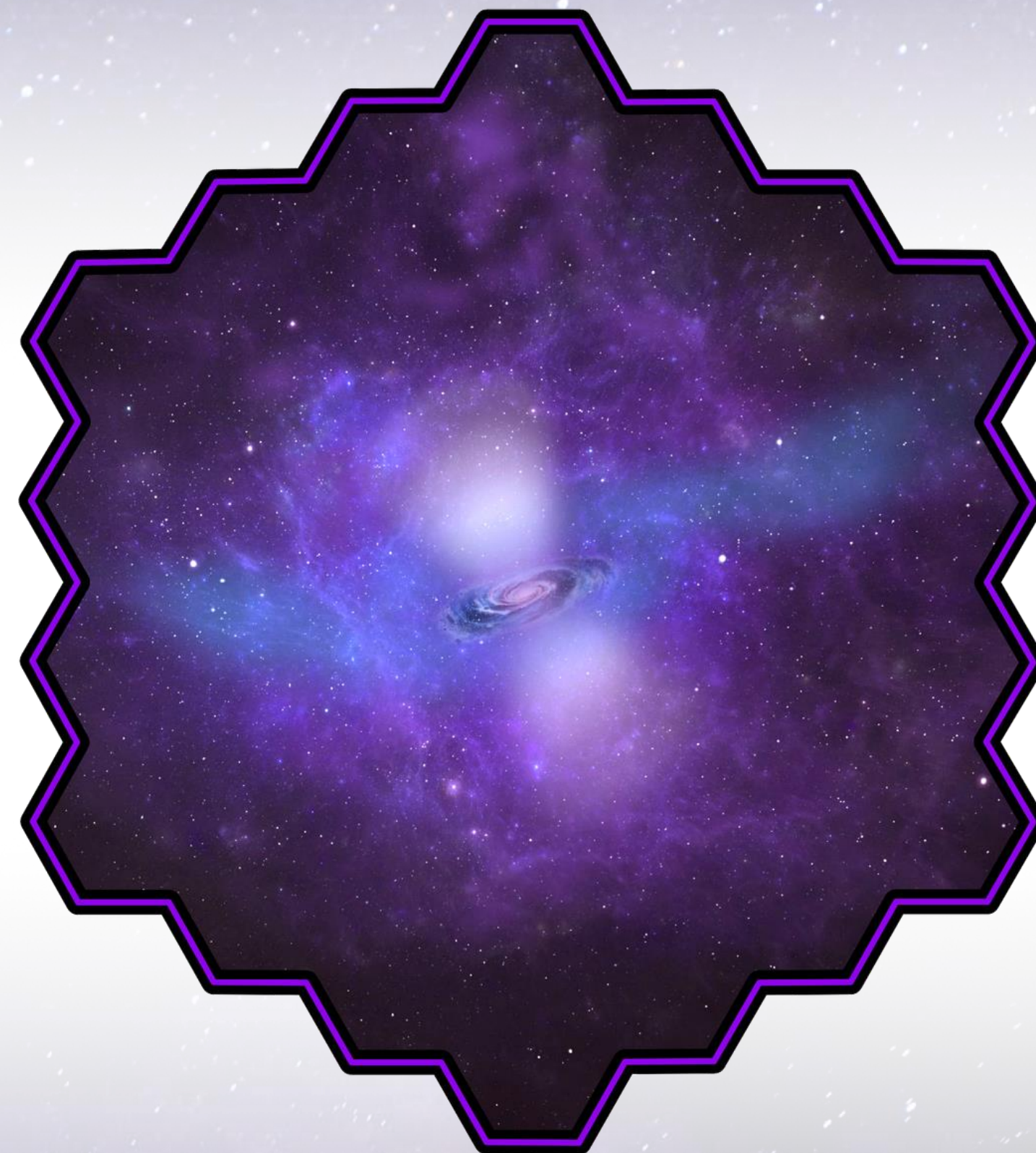


Image Credit: Cristy Roberts from ANU/ASTRO
3D

The CGM



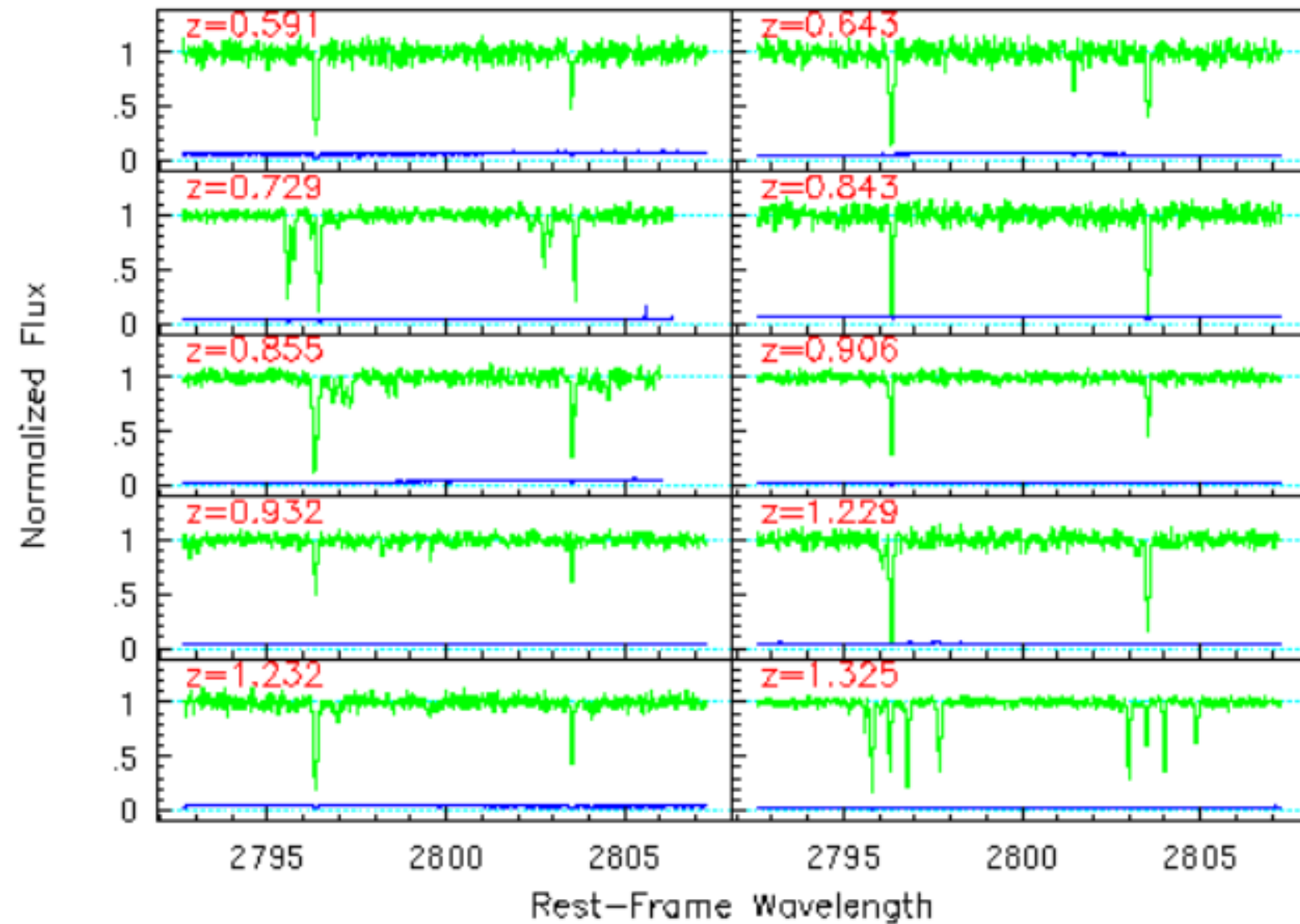
Image Credit: James Josephides

- The CGM is a vast reservoir of gas surrounding a galaxy
- It provides many ways for a galaxy to implement inflows, outflows, and recycling mechanisms that in turn feed the galaxy
- The CGM is part of a broader picture, the Cosmic Ecosystem, that allows us to study galaxy evolution

MAGIICAT



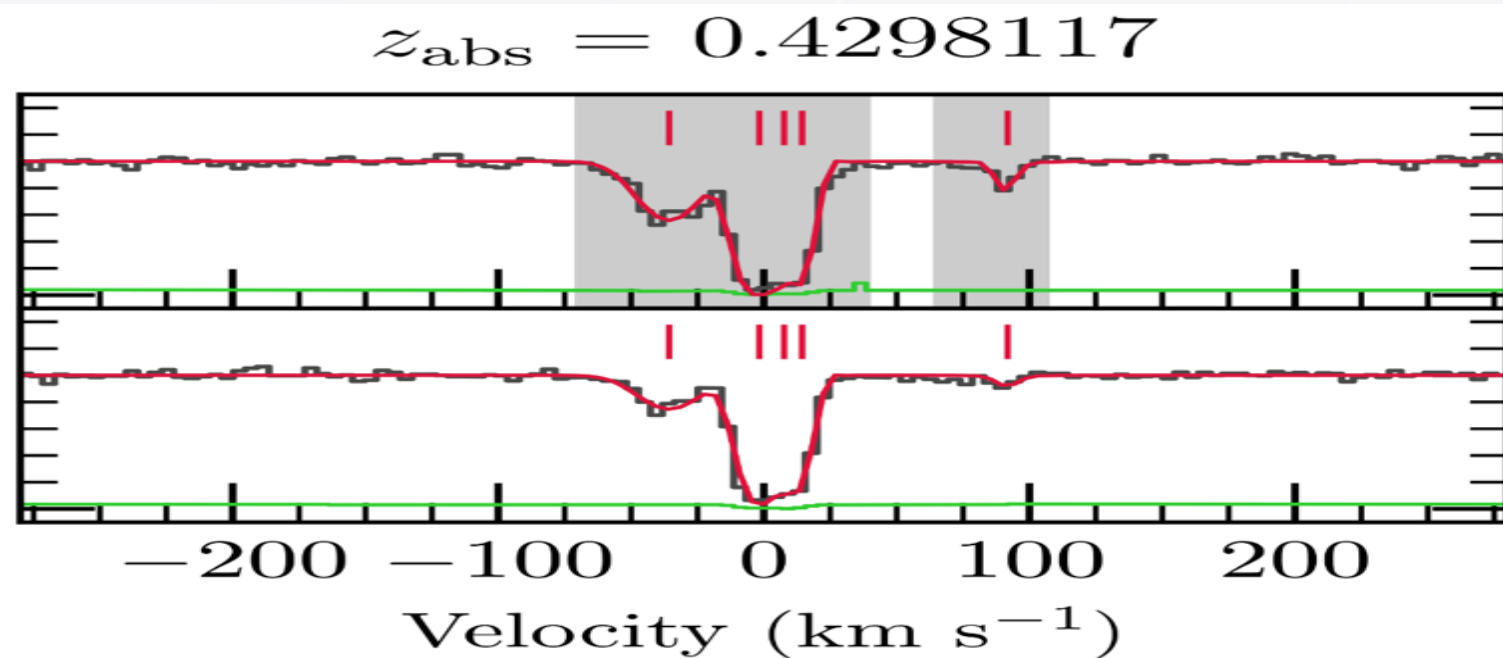
Sample of "Weak" Mg II Doublets



- Magnesium II Absorber-Galaxy Catalog
- The catalog contains 182 isolated galaxies and their properties
- The goal of Magiicat is to standardize data from literature in order to use observational trends to explain evolutionary processes

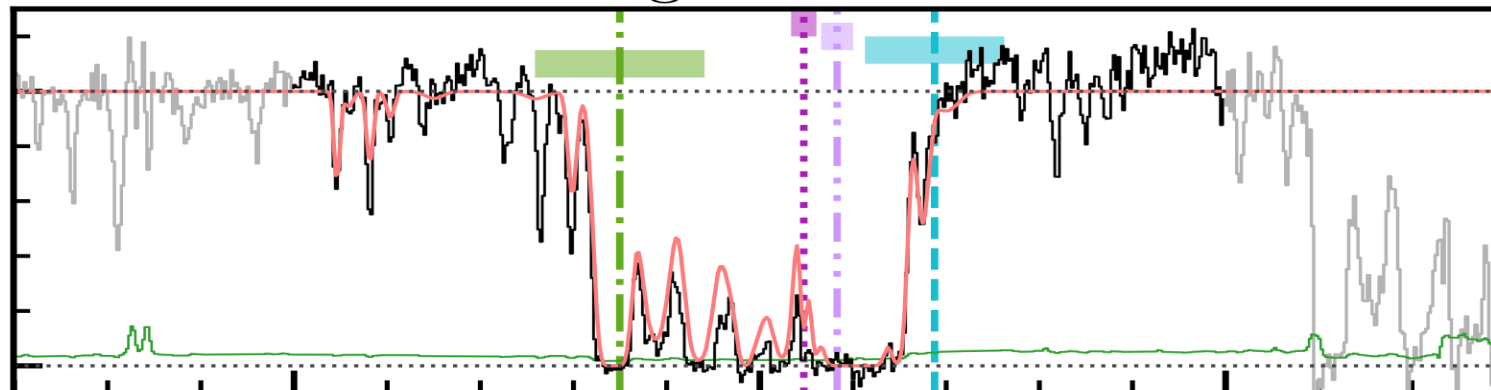
USMg II Papers

- Collection of three papers from Guha et. al (2022,2023,2024)
- Ultra-Strong Mg II absorbers display greater equivalent widths and assert that a more complex gas dynamic is occurring
- 126 galaxy-absorber pairs have been collected across the papers

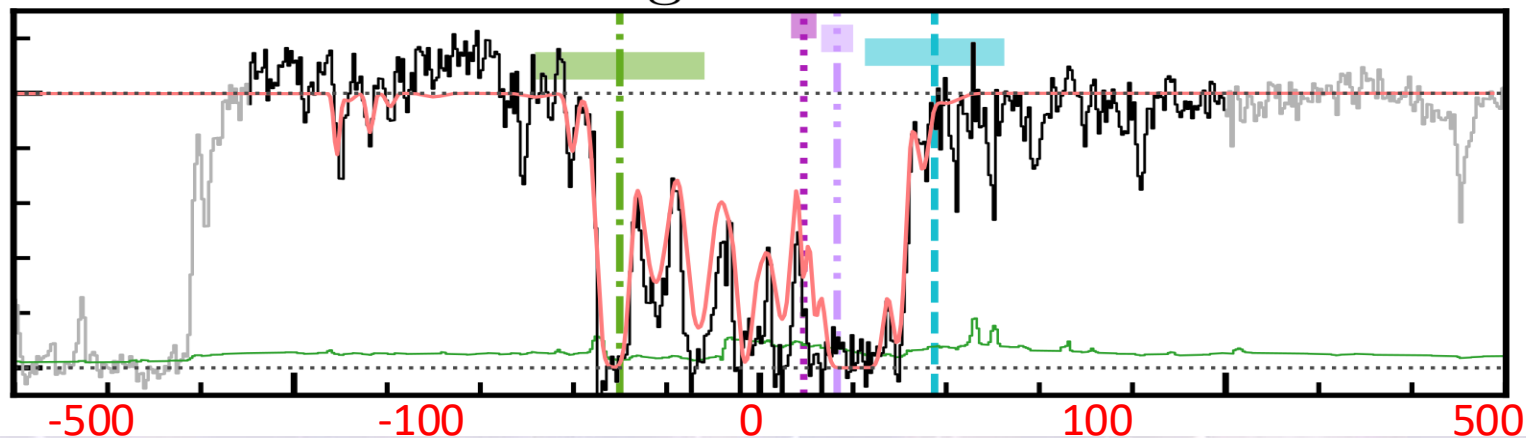


$z_{\text{abs}} = 2.43$

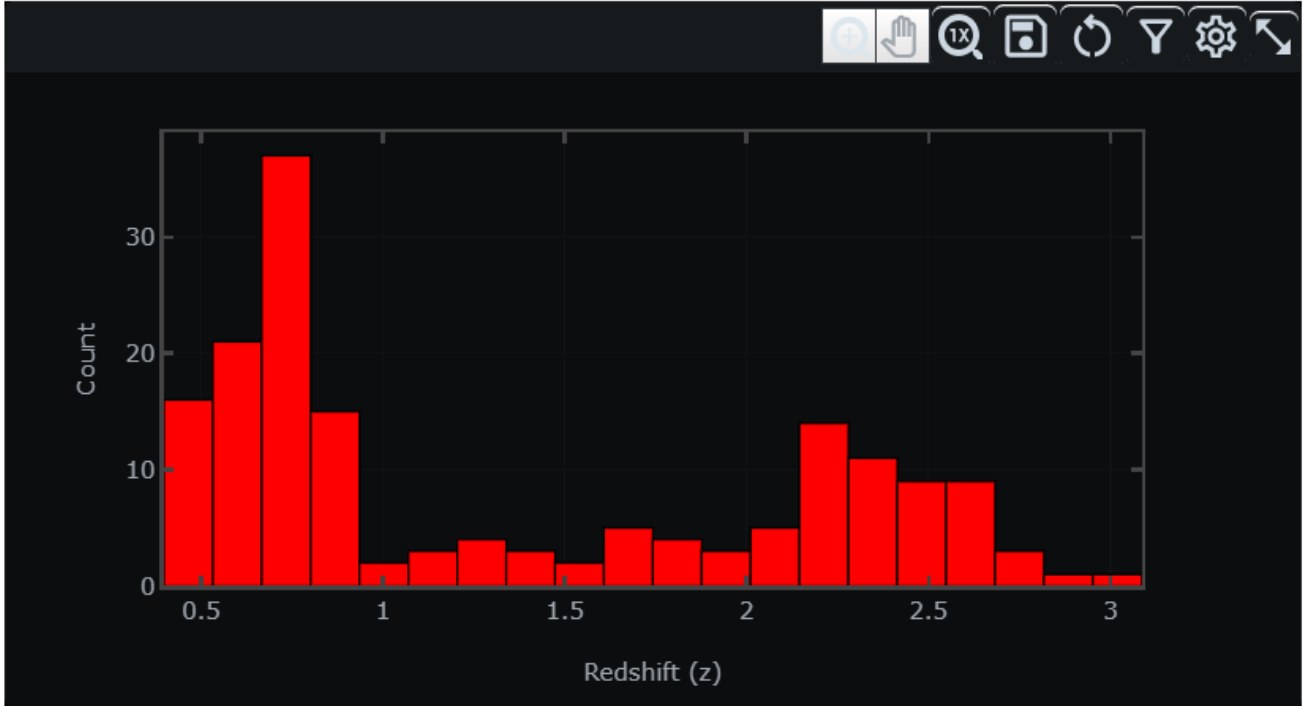
Mg II $\lambda 2796$



Mg II $\lambda 2803$



Detective work/NED

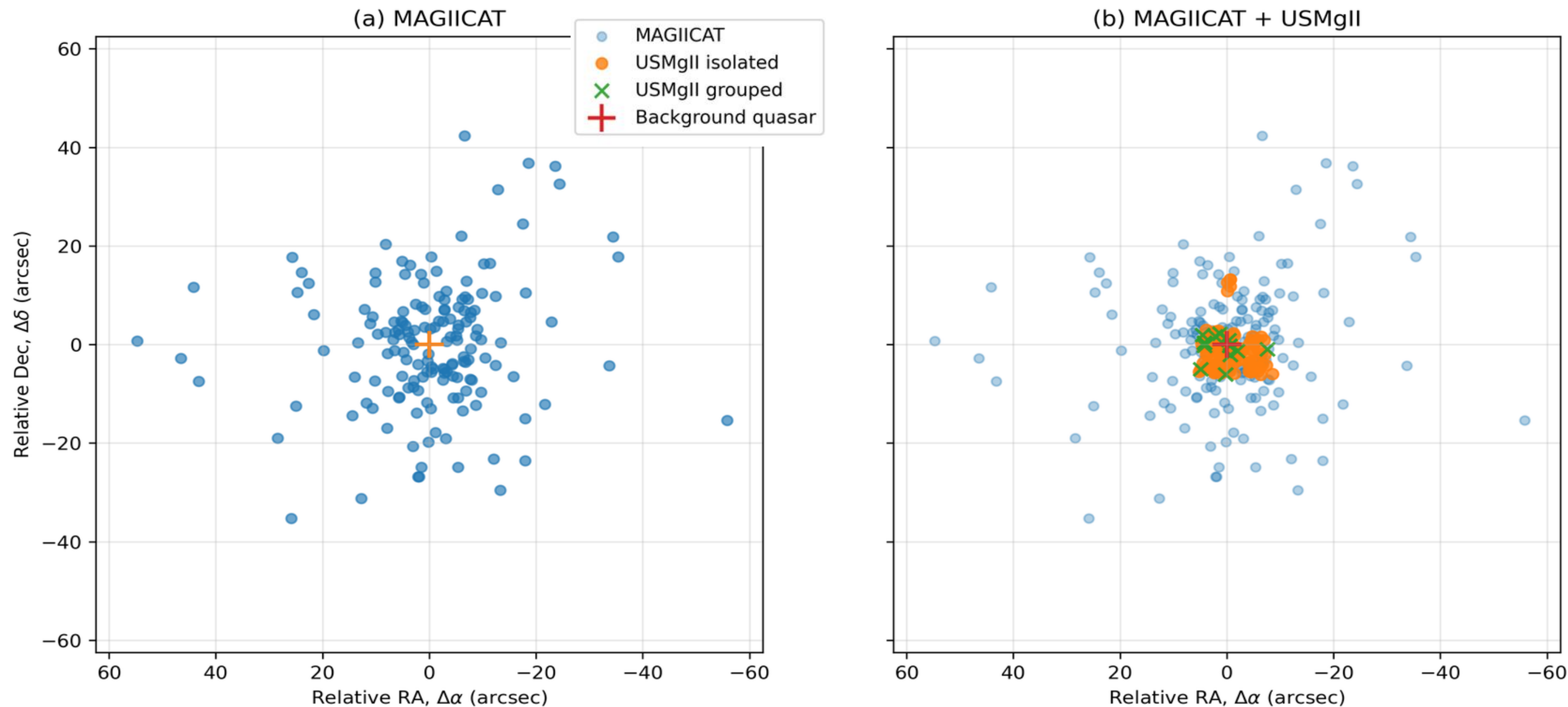


1 of 1 (1 - 168 of 168)																
No.	Object Name	RA-s	Dec-s	RA (deg)	Dec (deg)	Redshift (z)	cz (km/s)	z flag	Phys Type	EM Region	Reference	Note	Photometry	Position	Re	
integer	char	char	char	double	double	double	double	char	char	char	integer	integer	integer	integer	integer	integer
154	GOTOQ J1454+4424 GAL	14h54m52.2400s	+44d24m09.100s	223.717667	44.402528	0.663000	198762	SUN	G		1	0	0	1		
155	GOTOQ J1502+1806 GAL	15h02m16.1700s	+18d06m57.398s	225.567375	18.115944	0.544200	163147	SUN	G		1	0	0	1		
156	GOTOQ J1509+2630 GAL	15h09m28.5000s	+26d30m02.800s	227.368750	26.500778	0.779000	233538	SUN	G		1	0	0	1		
157	GOTOQ J1509+1252 GAL	15h09m36.0900s	+12d52m44.900s	227.400375	12.879139	0.540500	162038	SUN	G		1	0	0	1		
158	GOTOQ J1518+5815 GAL	15h18m57.9799s	+58d15m27.500s	229.741583	58.257639	0.647000	193966	SUN	G		1	0	0	1		
159	GOTOQ J1525+2647 GAL	15h25m02.6299s	+26d47m30.699s	231.260958	26.791861	0.912600	273591	SUN	G		1	0	0	1		

- Most papers included a reference code link to NED
- incredibly massive database of roughly 1.6 billion extragalactic objects
- supplementary data files through MNRAS

Galaxy Position relative to background quasar

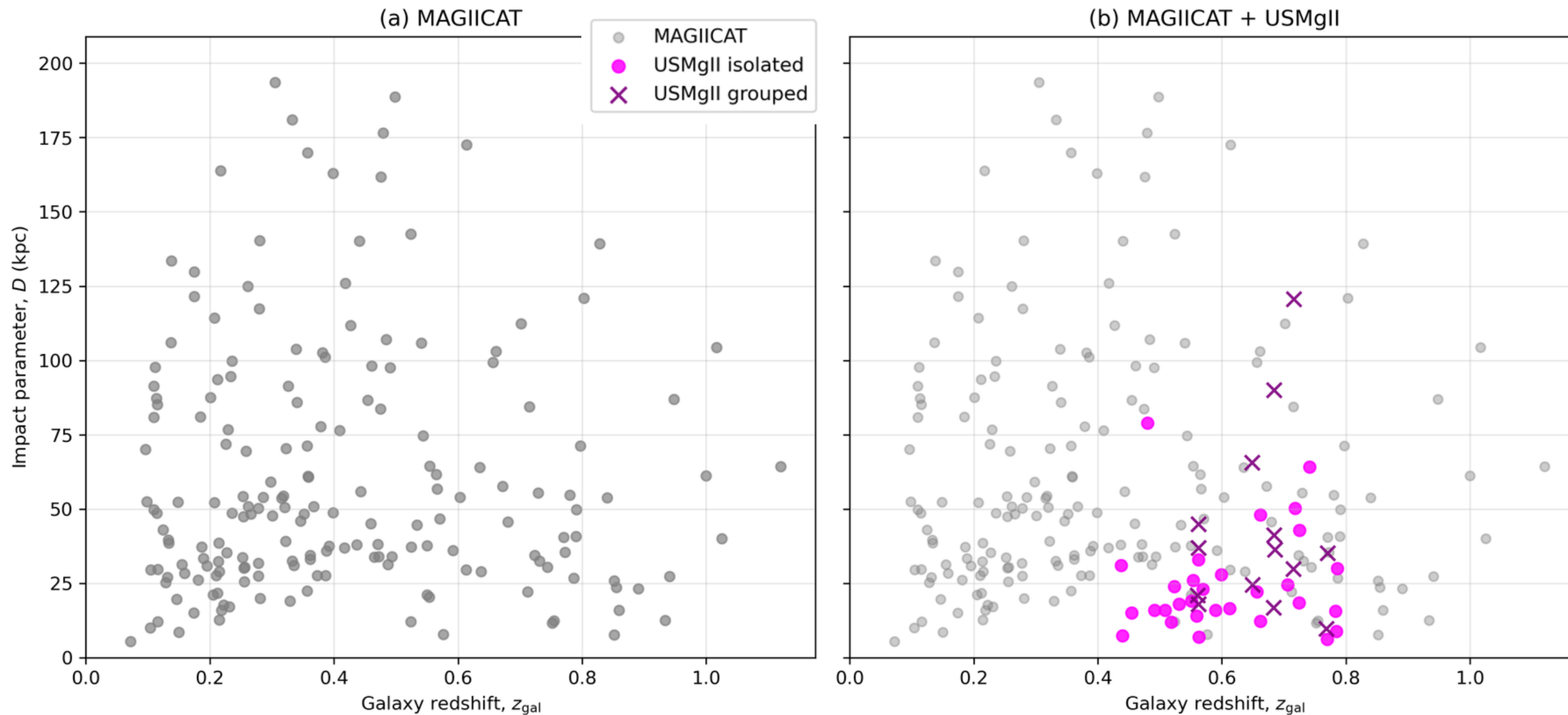
Angular offsets from the background quasar



- Provides a map of sightlines that tells us where our galaxies lie
- Extremely high concentration near the quasar sightline, which is expected

Impact parameter and redshift

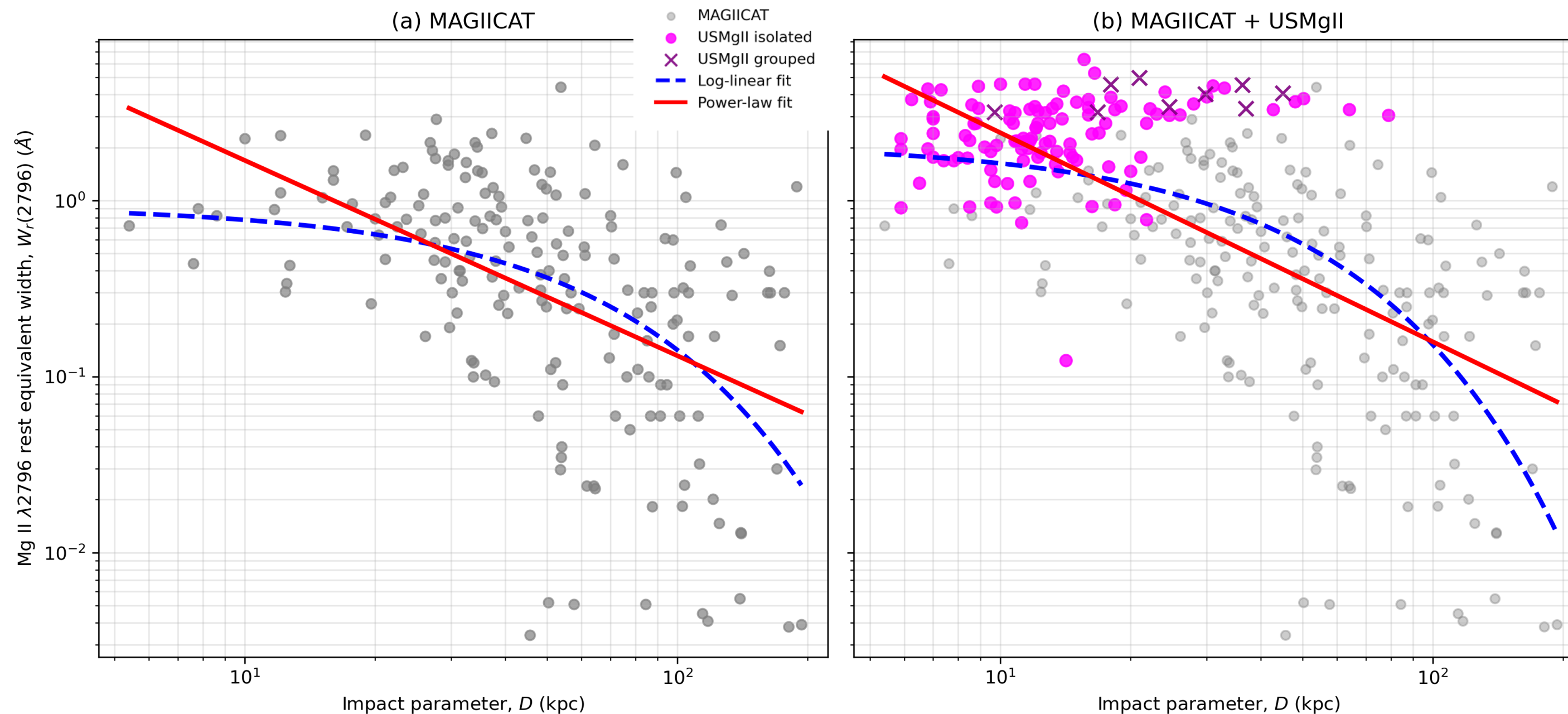
Impact parameter as a function of galaxy redshift



- No noticeable trend across the data sets as a whole
- CGM is being uniformly probed
- Absorber type is not dependent on cosmic epoch observed

Impact parameter as a function of Equivalent width

Mg II equivalent width as a function of impact parameter



- A commonly known trend of Mg II absorbers is the anticorrelation between equivalent width and impact parameter
- Gas distributions of USMg II absorbers are explained by more complex mechanism occurring

Conclusion

- Future work in the data can include using galaxy luminosity properties, covering fractions, and galactic mass properties, I plan to continue this work for Capstone
- Direct imaging of the CGM is incredibly difficult, so probing the gas is our best option for being able to picture the galaxy itself
- Questions?

Thank you!

