

Ram Pressure Stripping & HI Radial Profiles

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and
The GIMIC Collaboration

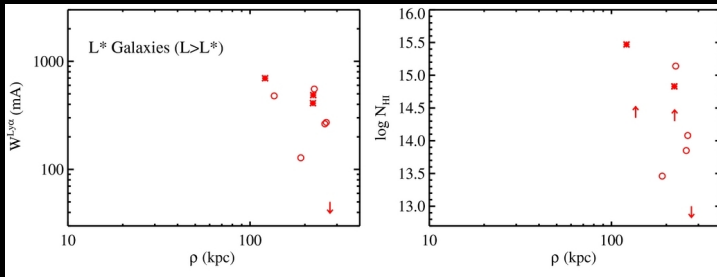
March 21, 2013



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Probing HI in the Outskirts of Galaxies

- ▶ It has only probed by QSO absorption lines eg. Prochaska et. al. 2011.

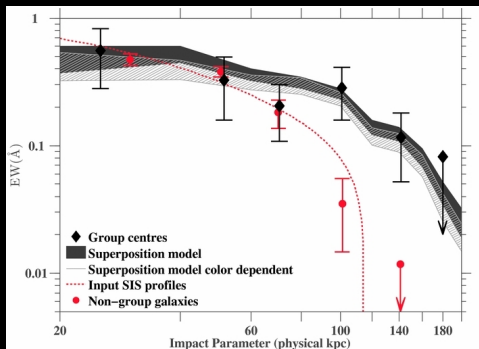


L^* Galaxies

Prochaska et. al. 2011

Environment Dependence?

- ▶ Recent work by Bordoloi et. al. 2011 has probed these regions with MgII absorption and observed an environmental dependence which was explained by superposition.
- ▶ Stacking of ~ 4000 zCOSMOS galaxies.



Galaxies Intergalactic Medium Interaction Calculation (GIMIC)

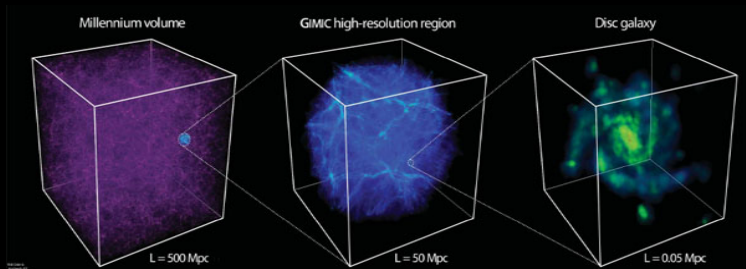


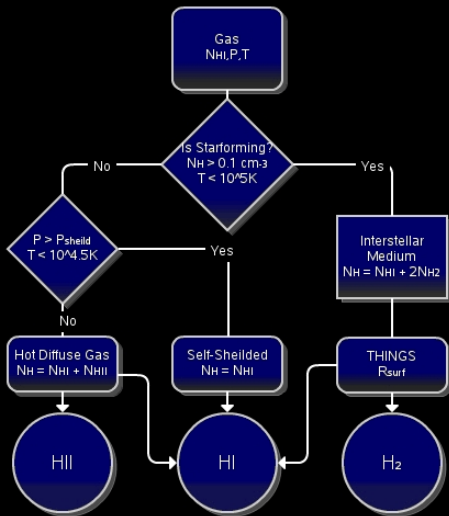
Image Credits: Virgo Consortium

Crain et. al 2009.

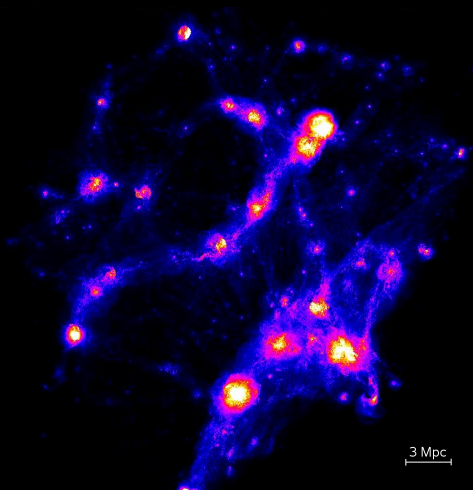
The Simulation

- ▶ GADGET-3 (N-body and Hydrodynamic)
- ▶ Contains Dark Matter, Stars and Gas(SPH)
- ▶ 32 Mpc sphere with 700 pc gravitational softening
- ▶ 2.75×10^8 dark matter particles and 2.75×10^8 baryonic particles
- ▶ DM particle mass $1.16 \times 10^7 M_{\odot}$, Baryonic Mass $1.45 \times 10^6 M_{\odot}$
- ▶ Includes:
 - ▶ Gas cooling and photoionisation
 - ▶ Star formation and feedback, "MILL" model, Schaye et. al. 2010.
 - ▶ Kinetic feedback (Supernovae)
 - ▶ Chemodynamics

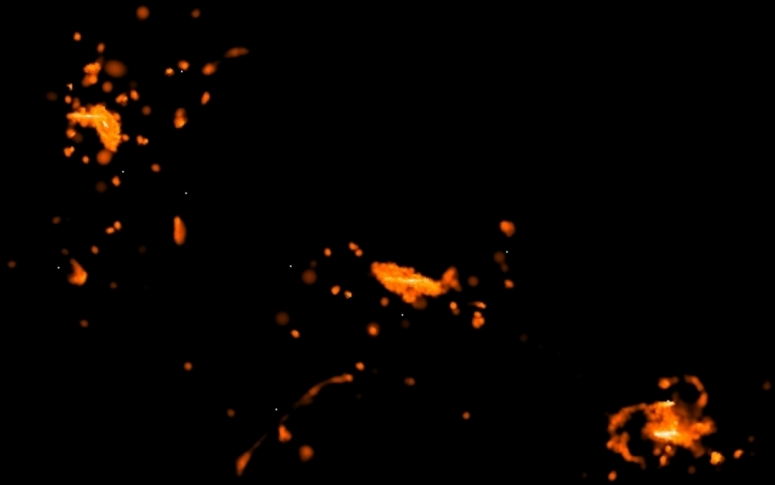
Calculating the Neutral Fraction in SPH Particles



Neutral Hydrogen

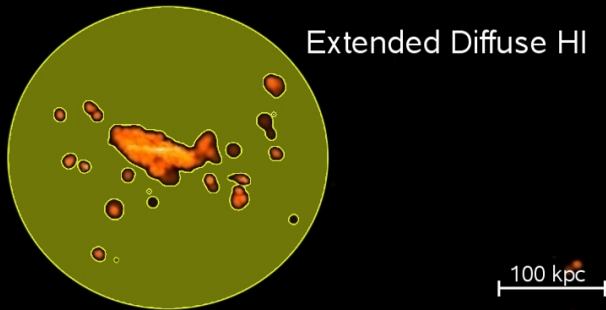


HI disks



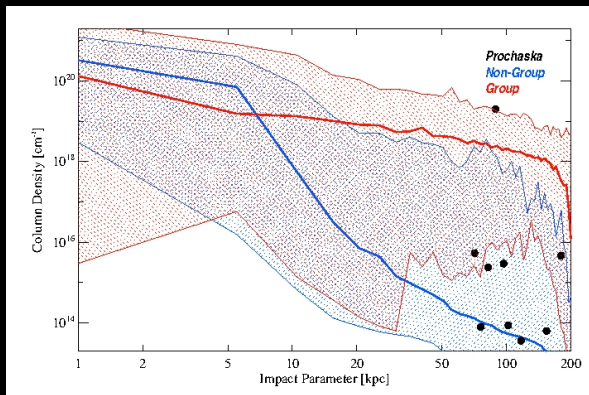
100 kpc

Back to the diffuse HI



Galaxies

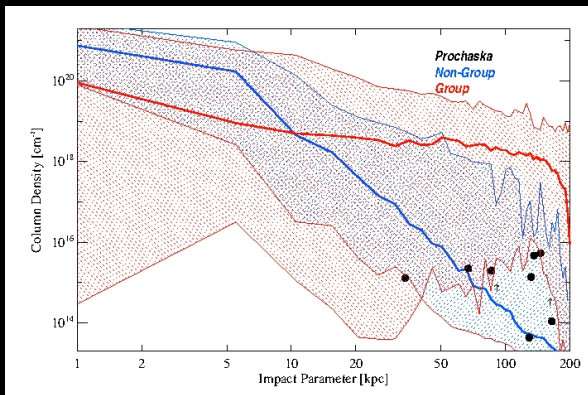
$10^9 < \text{Stellar Mass} < 10^{10}$



Plotted points: < 0.1L QSO Absorbers Prochaska 2011*

Galaxies

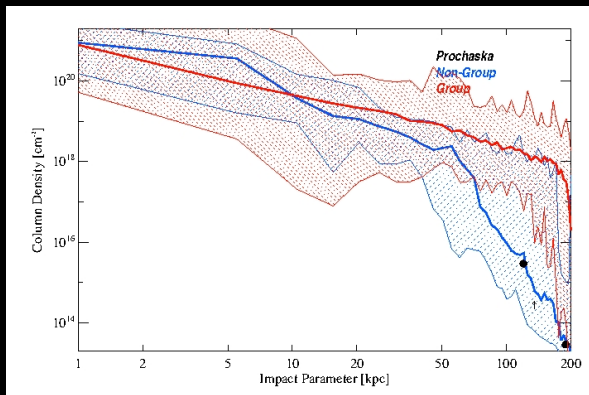
$10^{10} < \text{Stellar Mass} < 10^{11}$



Plotted points: < L QSO Absorbers Prochaska 2011*

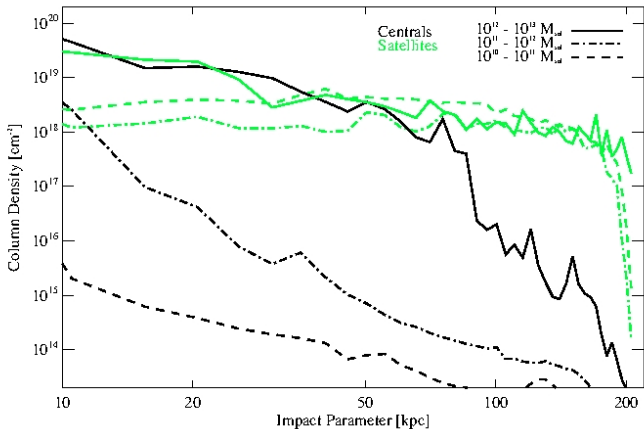
Galaxies

Stellar Mass $> 10^{11}$

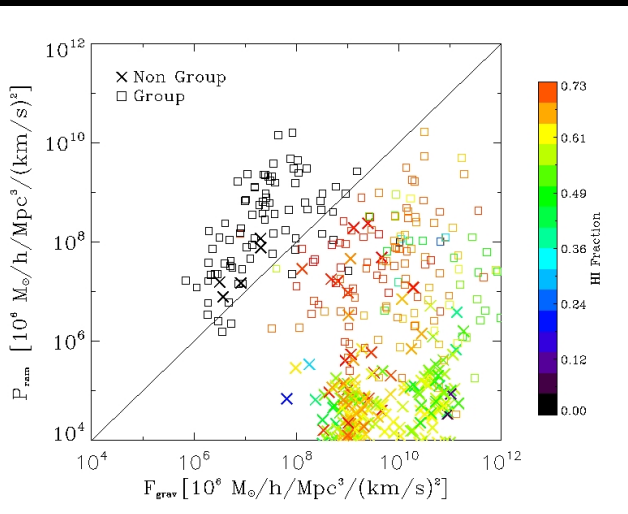


Plotted points: L QSO Absorbers Prochaska 2011*

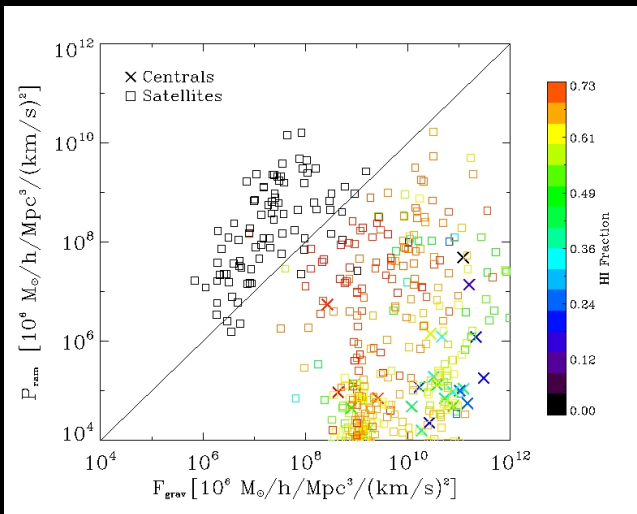
Central vs Satellite Galaxies



Ram Pressure Stripping



Ram Pressure Stripping



Summary

- ▶ Field galaxy profiles are well reproduced and in agreement with Prochaska et. al. 2011
- ▶ In groups we find a large reservoir of HI in the outskirts of galaxies.
- ▶ We see this effect at all mass ranges.
- ▶ We suspect this is be due to ram pressure stripping.

Future Work

- ▶ Investigate how this effect evolves with redshift.
- ▶ Investigate azimuthal and other dependencies as well as metallicity profiles.

Future Observations

- ▶ Upcoming survey instruments such as MeerKAT and ASKAP will not be able to probe these column densities directly.
- ▶ Stacking of large datasets though may yield detections of diffuse HI in the outskirts of galaxies.

Acknowledgements

I'd like to acknowledge the support of the following institutions:



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Ram Pressure Stripping

- ▶ In addition it has been observed that group galaxies are HI deficient. Kilborn et. al. 2009.

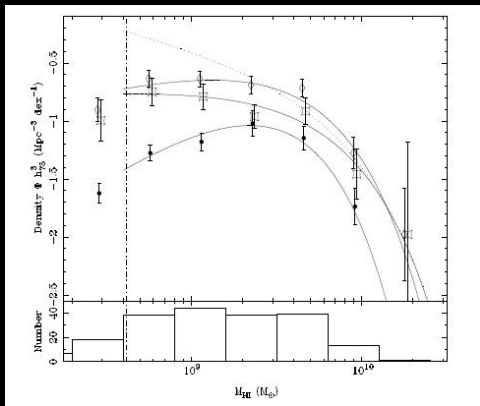
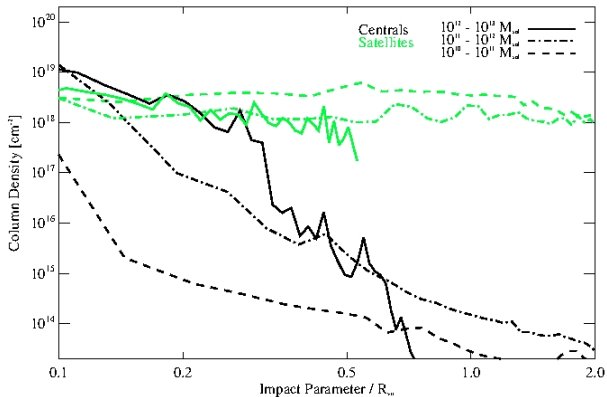


Figure: HI mass function for the composite group. The open diamonds show the HI mass function for all galaxies we detected in the HI cubes, the filled circles are for galaxies determined to be members of groups, and the open squares are the galaxies that are not members of the groups

Central vs Satellite Galaxies



HI Mass Function

