Gaseous Evolution in Galaxies: The Arecibo Ultra-Deep Survey (AUDS)

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**Motivation**

I the global co-moving star formation rate increases by about a factor of five between z=0 and z=1 (e.g. Hopkins 2004) — should correspond to increase in the density of cool gas, which is the fuel for star formation. ΩHI ≈ (1+z)^3 (Peebles et al. 1999, Cole et al. 2000, Baugh et al. 2004).

I number density of Damped Lyman-α Absorbers (DLA) as function of a distance only mildly declines (1+z)^1.5 (e.g. Peroux et al. 2003, Zwaan et al. 2005).

? Do DLAs trace bulk of gas available for star formation?

**Discussion of Precursor Results**

For each galaxy, the maximum accessible volume was calculated and a binned HI mass function was computed using the 1/\(V_{\mathrm{max}}\) method. Preliminary results suggest a galaxy detection rate which is a factor of 2-3 times higher than expected from the local HI mass function derived from HIPASS (Zwaan et al. 2003).

**Future Observations**

beamwidth of the Arecibo telescope (3 arcmin) and the lack of completeness of redshift information in the field make it impossible to unambiguously identify optical counterparts. High-resolution HI maps to identify galaxies will be obtained at GMRT in February 2006. full AUDS plans survey larger field of view (0.36 deg^2); longer integration times (40 hrs per pointing), giving lower noise levels (1000 Jy) over the full redshift range 0<z<0.16. The rms sensitivity will be a few 10^7 solar masses at z=0.2.

In the future, detections of HI in emission will be possible at redshifts above 0.5 with the proposed extended New Technology Demonstrator (eNTD) and SKA Molonglo Prototype (SKAMP) telescopes in Australia, and possibly with other SKA pathfinder telescopes.

**The AUDS Team**

The AUDS team consists of members of the Arecibo EGAL who are interested in deep HI observations. Current members are:


**References**

Baugh C.M. et al. 2004, NewAR, 48, 1228


Zwaan M.A. et al. 2006, astro-ph 05101270


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**Arecibo Ultra-Deep Survey (AUDS)**

- New ALFA feed array allows 21 cm HI surveys up to z~0.16
- AUDS aims to survey 0.36 square degrees
- precursor observations demonstrated feasibility of deep observations

**Precursor Observation**

- part of the commissioning phase of the Arecibo L-Band Feed Array (ALFA)
- total of 53 hr observing was acquired in 'drift-and-chase' mode
- maximum integration time per beam of 16 hrs per beam
- data reduction with ALFA LiveData and Gridzilla modified for radio-frequency interference mitigation

**Results**

- rms of the spectra in the most sensitive part of the precursor data is 80 Jy which was close to theoretical expectation.
- 14 well-detected HI lines and nine candidate detections between redshift 0.07 to 0.15.
- there are nine well-detected HI lines and six candidates with z>0.1.
- this is a larger sample than all previously published HI detections at these redshifts.
- first blind 21 HI survey which overlaps in z with DLA surveys

**Future Observations**

- largest redshift space survey of galaxies in the Universe as modelled by HIPASS (Zwaan et al. 2003).
- full AUDS plans survey larger field of view (0.36 deg^2); longer integration times (40 hrs per pointing), giving lower noise levels (1000 Jy) over the full redshift range 0<z<0.16. The rms sensitivity will be a few 10^7 solar masses at z=0.2.

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