Comparing Galaxies and QSO Absorption Lines

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At $z=0$, galaxies are **DLAs seen in emission**

- Local galaxies can account for low $z$ DLA incidence rate
- ... and explain DLA metallicities
- ... and other properties: impact parameters, luminosities
The shape of $f(N)$ does not evolve

- What is this telling us?
- Laws of star formation similar at all redshifts?

- Zwaan et al. (2005)
  local galaxies
- Prochaska et al. (2008) (DR5)
  DLAs at $z=2.2-5$
Number of **HI atoms** does not evolve much

- DLAs are a "phase" not a "reservoir"
- Where is the missing gas?
Kinematics of DLAs different from local galaxies

- Interactions, winds and outflows increasingly important at higher z

Zwaan et al. 2008
The future...

★ Measure $\Omega_{\text{HI}}$ in emission at $z>0$
  - HIPASS/ALFALFA at $z=0.2-0.5 \rightarrow$ AUDS, and... SKA pathfinders
  - Why do we still want to know $\Omega_{\text{HI}}$?

★ Find the `missing gas’
  - ALMA surveys $\rightarrow$ molecules

★ Understand DLAs
  - Map individual DLAs $\rightarrow$ need SKA
  - SF in DLAs $\rightarrow$ CII emission with ALMA

★ Map sub-DLAs/Lyman Limit Systems in 21-cm emission
  - Deep surveys $\rightarrow$ AUDS, SKA...
**Arecibo Ultra-Deep Survey (AUDS)** (Freudling et al)

- Deepest blind HI survey: 50 μJy rms, 1000 hours are allocated
- 0.36 degree$^2$ out to z=0.16
- Two fields in SDSS regions, no bright 20-cm sources

- Precursor observations:
  - 53 hours of ‘drift-and chase’ resulted in 14 detections between z=0.07 and z=0.15
- Detections confirmed with WSRT