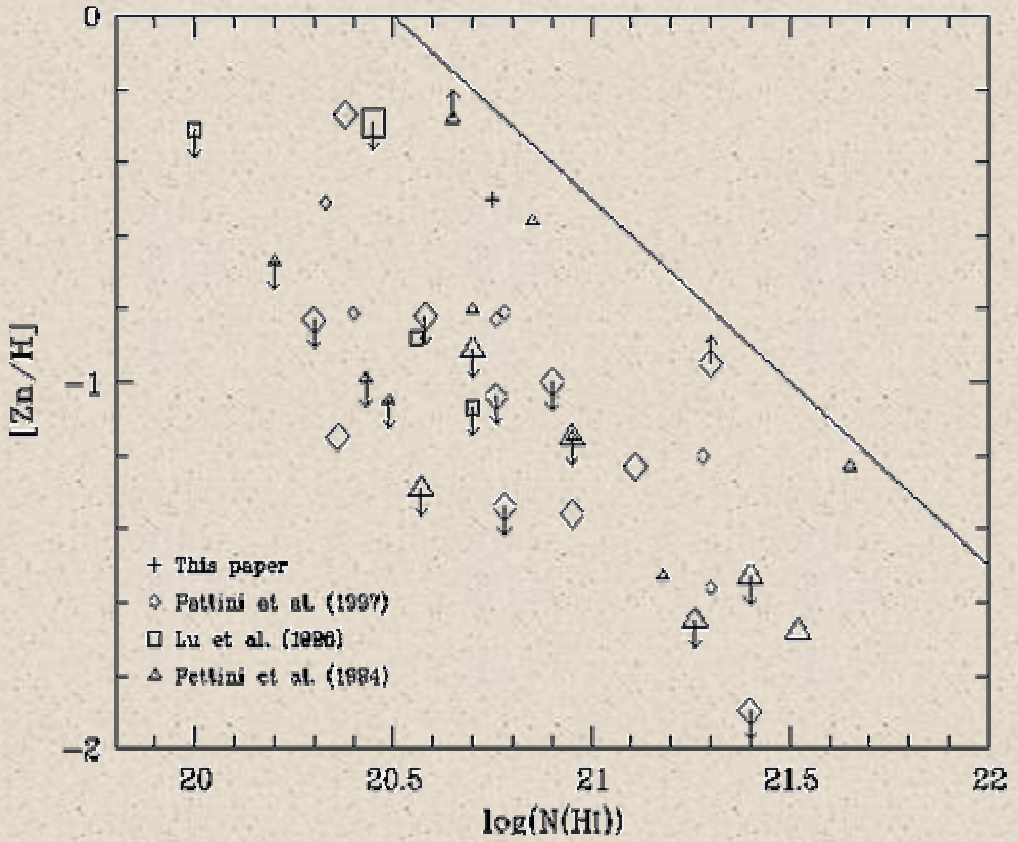
Star Formation Thresholds and the HI-H2 Transition

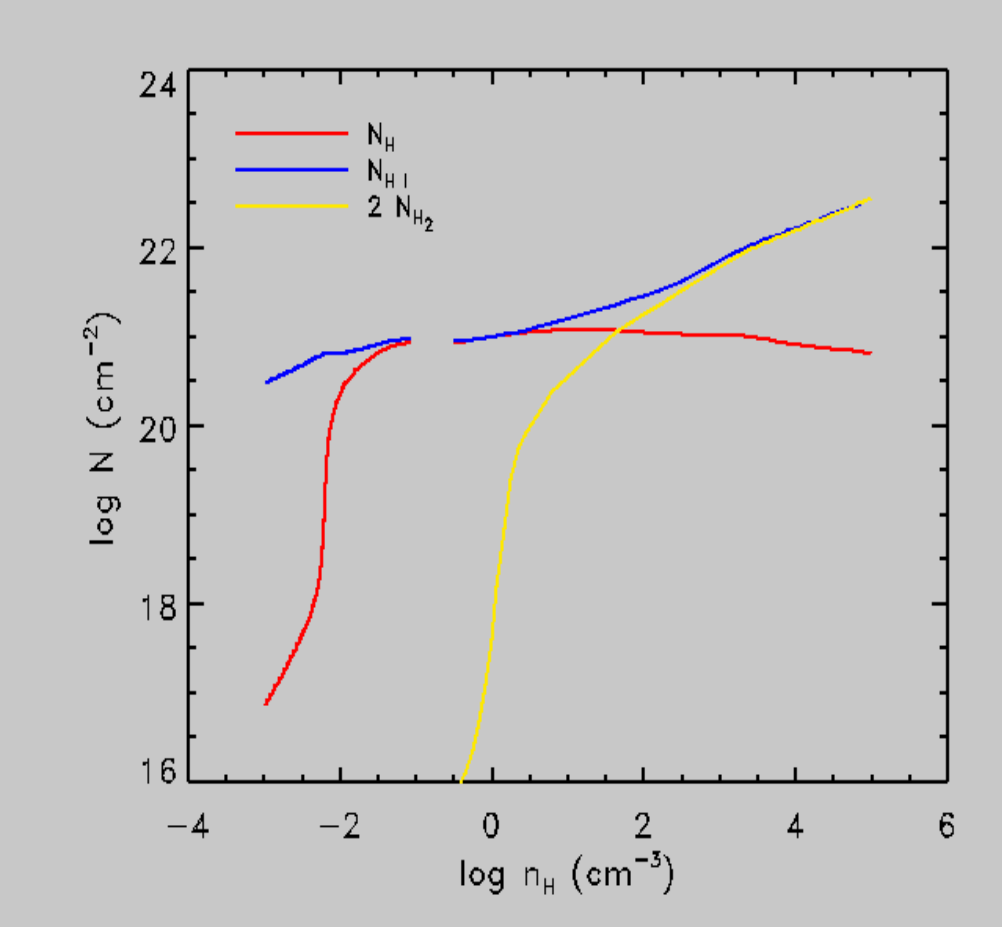
Joop Schaye (Leiden)

A maximum HI column for DLAs



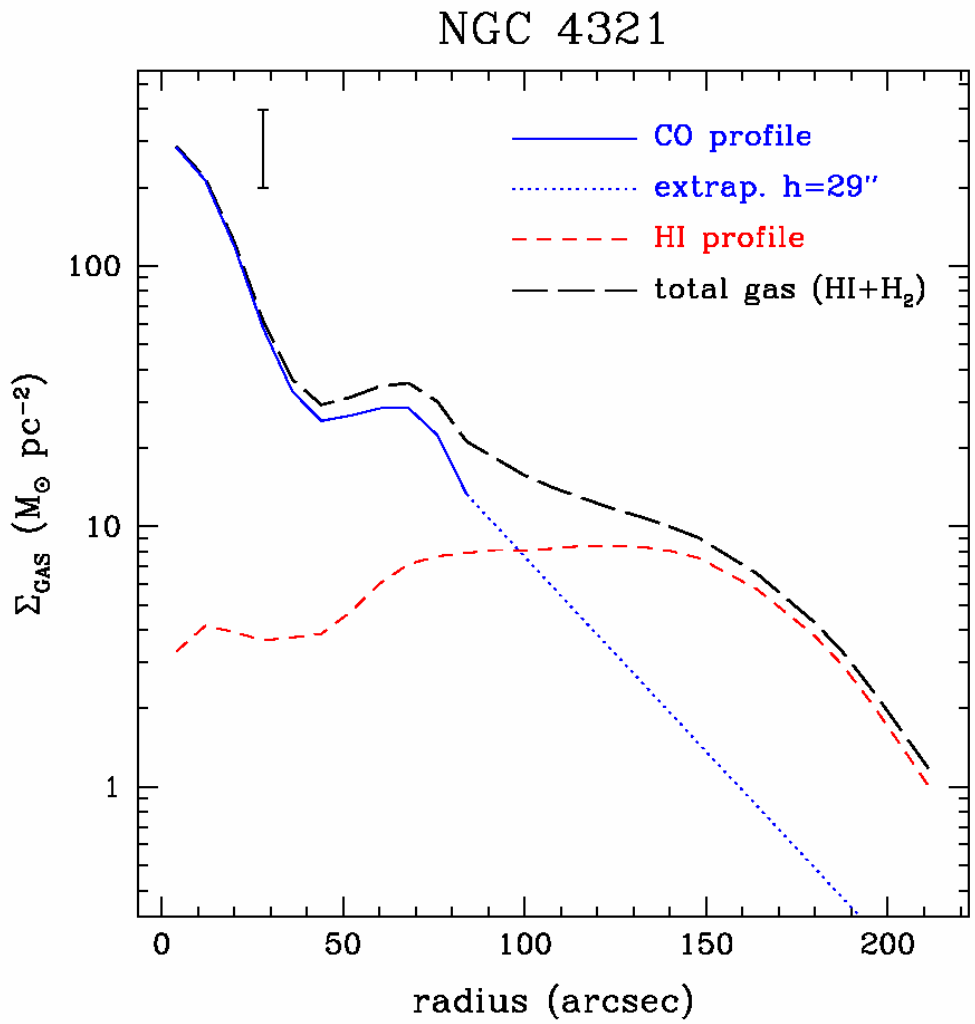
Boisse et al. (1998)

A physical upper limit on N(HI)



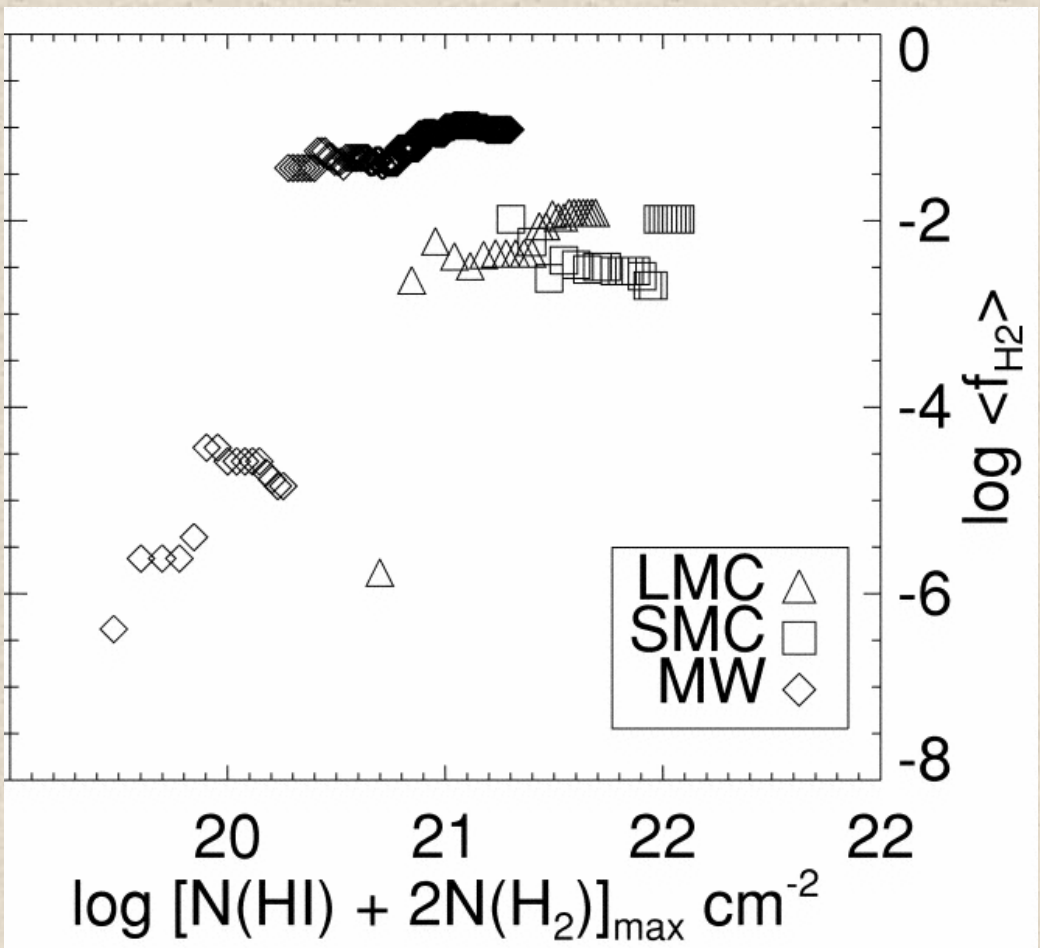
Schaye (2001)

A nearby galaxy



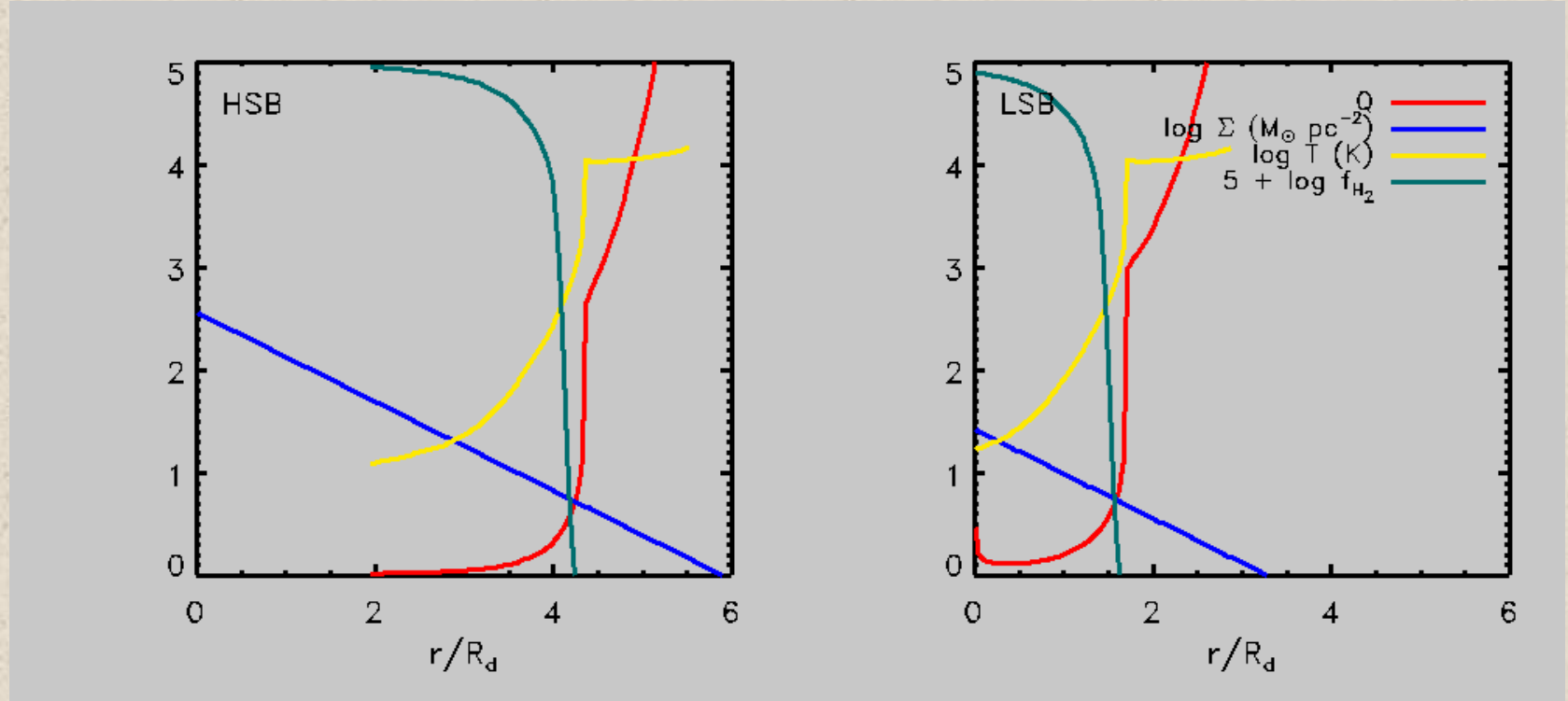
Wong & Blitz (2001)

Absorption line measurements



Tumlinson et al. (2002)

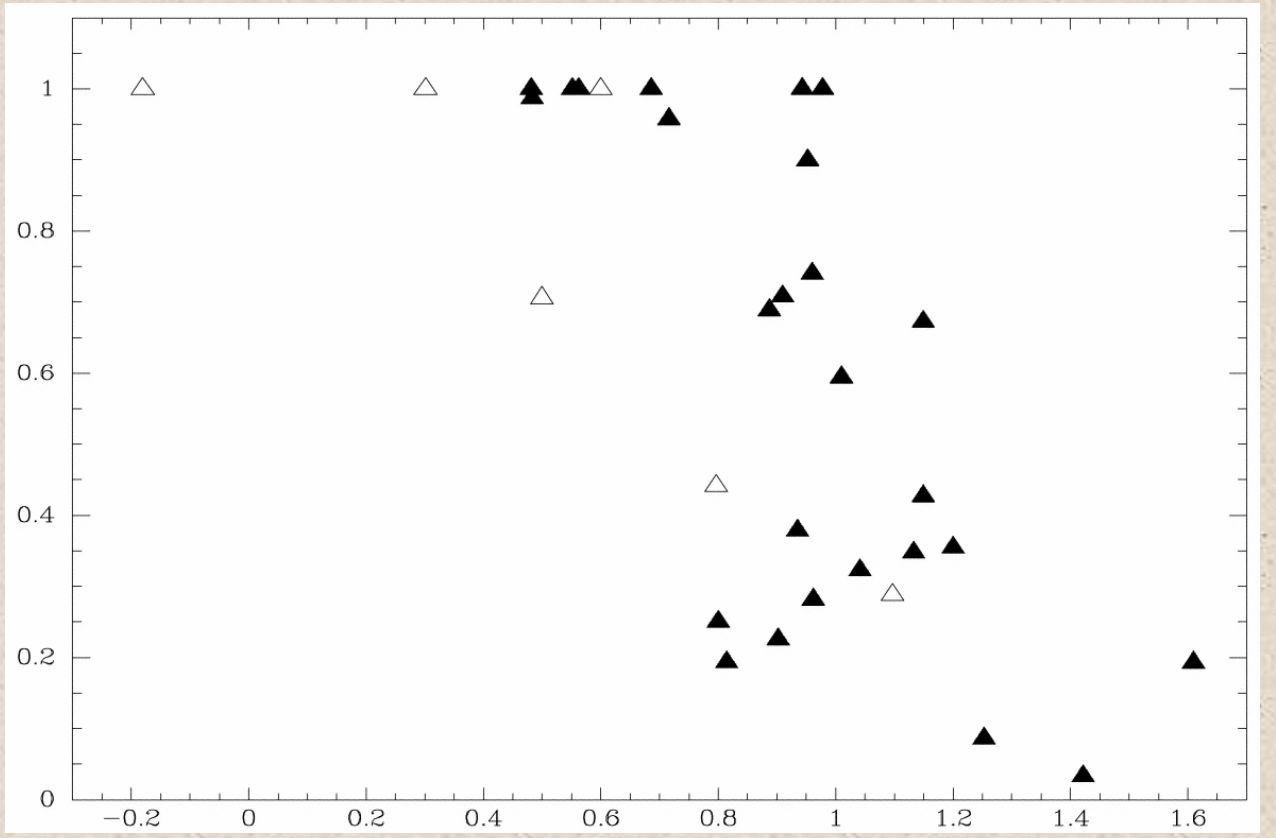
A star formation threshold



Schaye (2004)

Molecular fraction

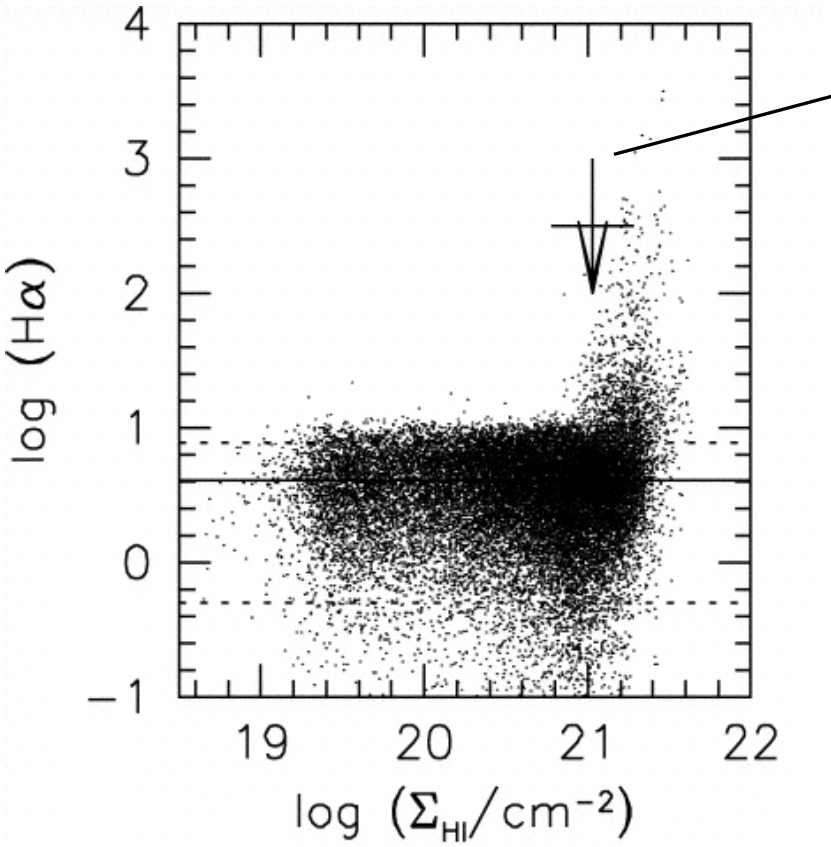
$1 - f_{H_2}$



$\log \Sigma_g \ (M_\odot \ pc^{-2})$

Martin & Kennicutt (2001)

Local analyis of LG dwarf NGC6822



S04
(inclin. Corr.)

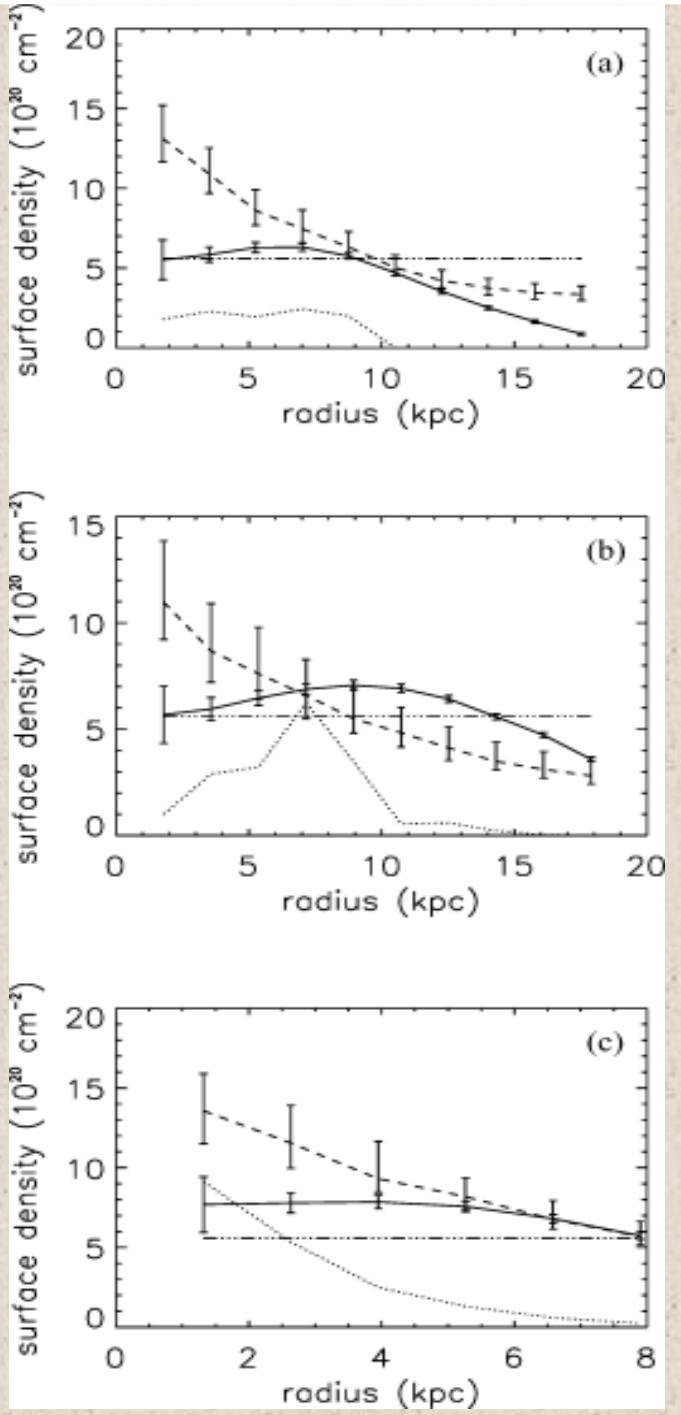
De Blok & Walter (2006)

Conclusions

- There exists a (metallicity-dependent) critical surface density of log N(HI) ~ 21 for the formation of a cold phase
- The transition to a cold phase triggers gravitational instability and sets a star formation threshold
- The predicted critical surface density explains:
  - The observed (metallicity-dependent) cut-off in the column DLA density distribution
  - The observed ceiling to the HI column from 21cm observations of nearby galaxies
  - The observed (local) star formation thresholds

Nearby LSB galaxies

——— Gas surface density
..... H-alpha
- - - - K89 critical surface density
— · · — S04 critical surface density



Auld et al. (2006)