

Radial Gas Distributions and the Gas Depletion Time Problem

Leo Blitz

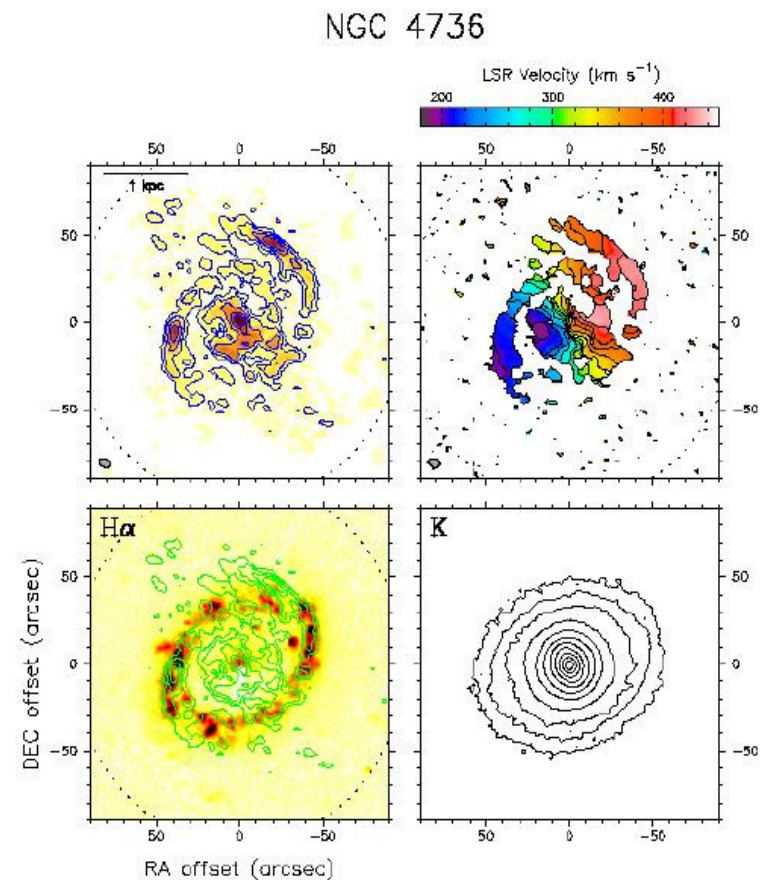
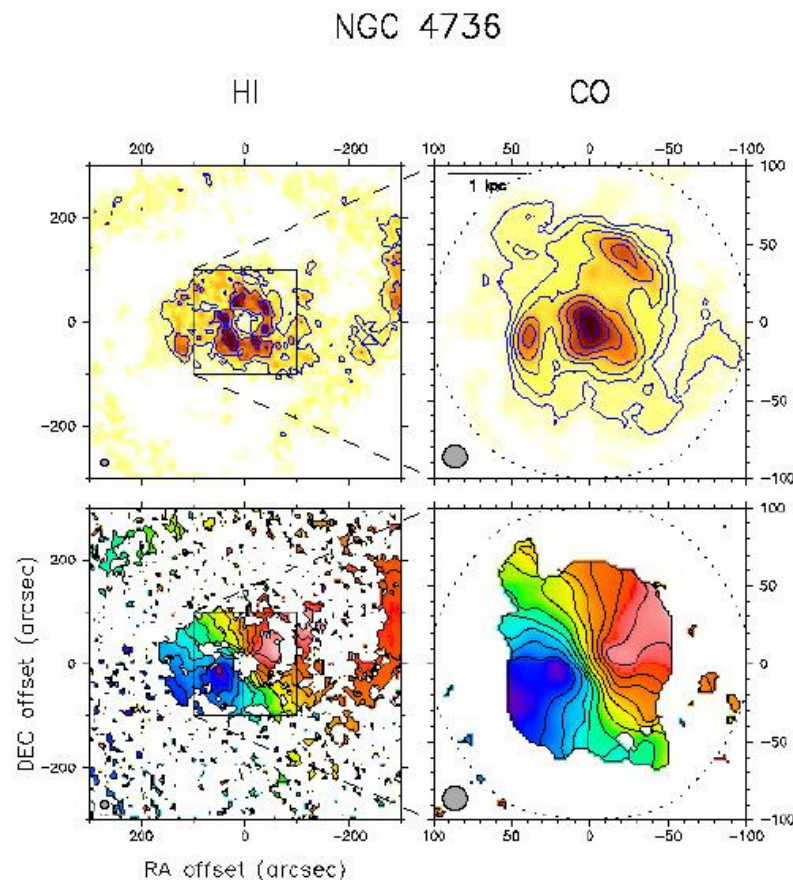
Andrew West

Erik Rosolwosky

Abbazia di Spineto, June 14, 2007

Consider Gas Depletion Times

Atomic, molecular gas and star formation in M94



Wong & Blitz 2002

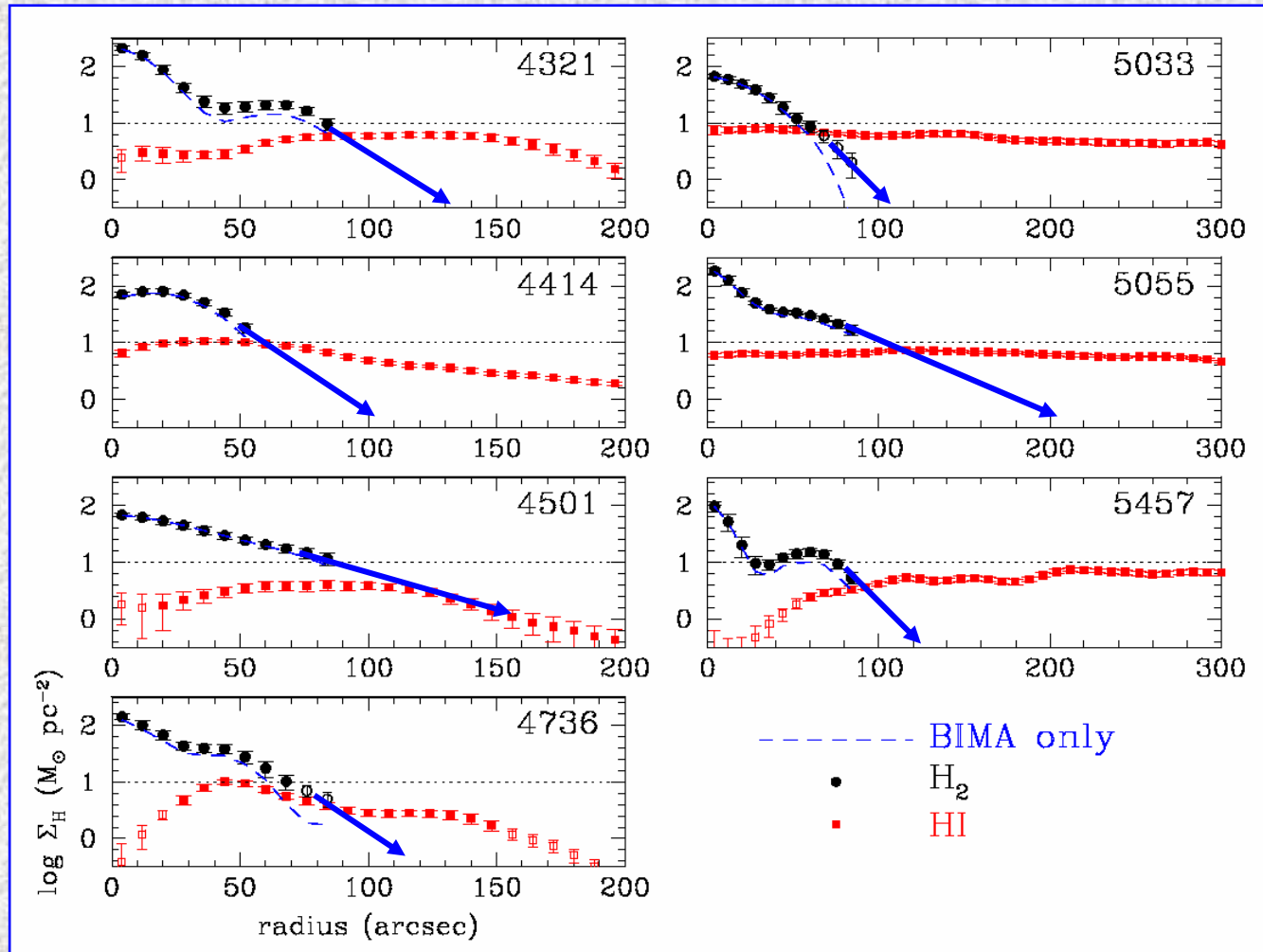
Radial Surface Density Profiles

HI roughly
constant with R;

Saturates at
 $\sim 8\text{--}10\text{ M}_{\odot}\text{pc}^{-2}$

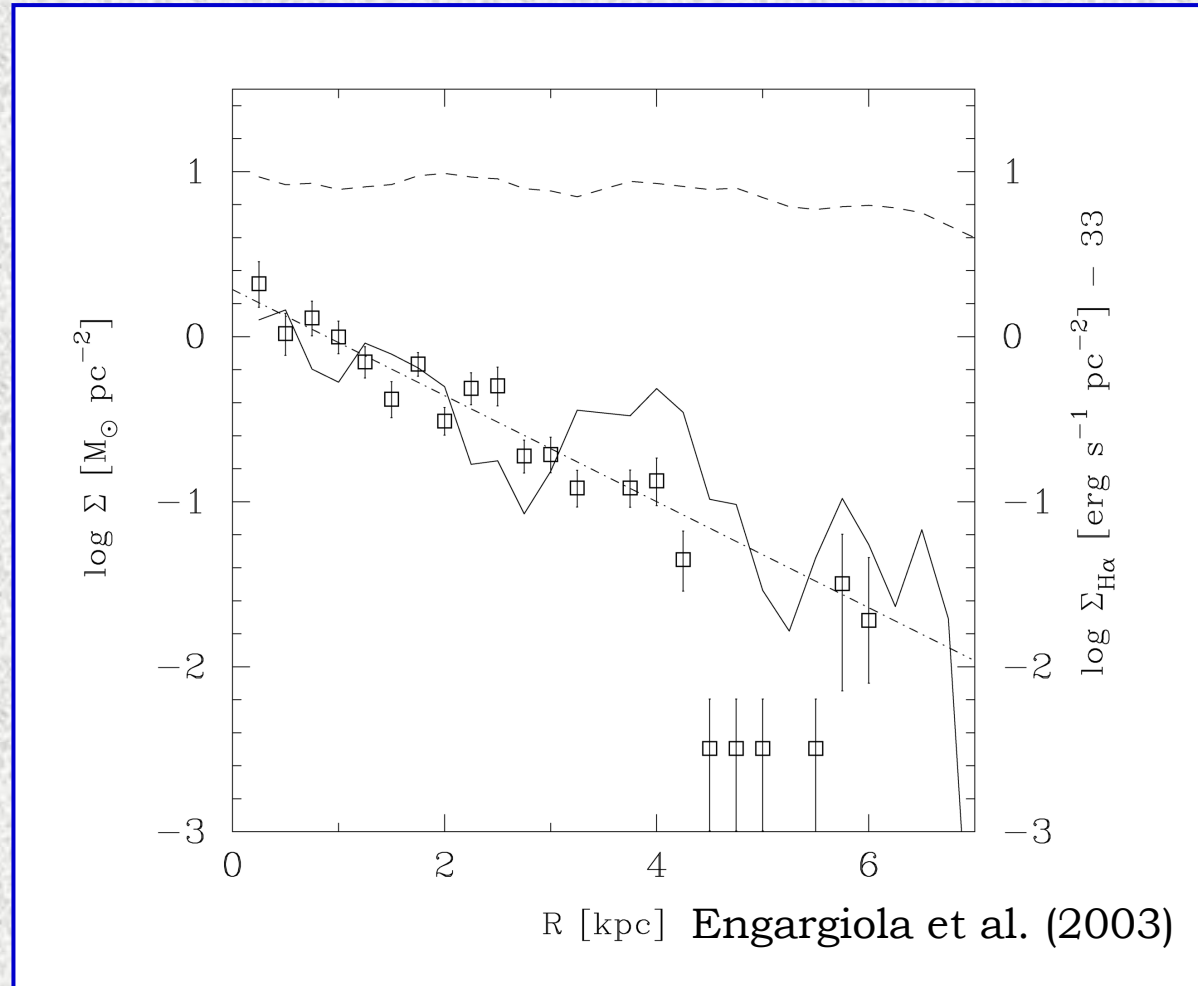
CO is
*monotonically
decreasing
(almost)*

*roughly
exponential*



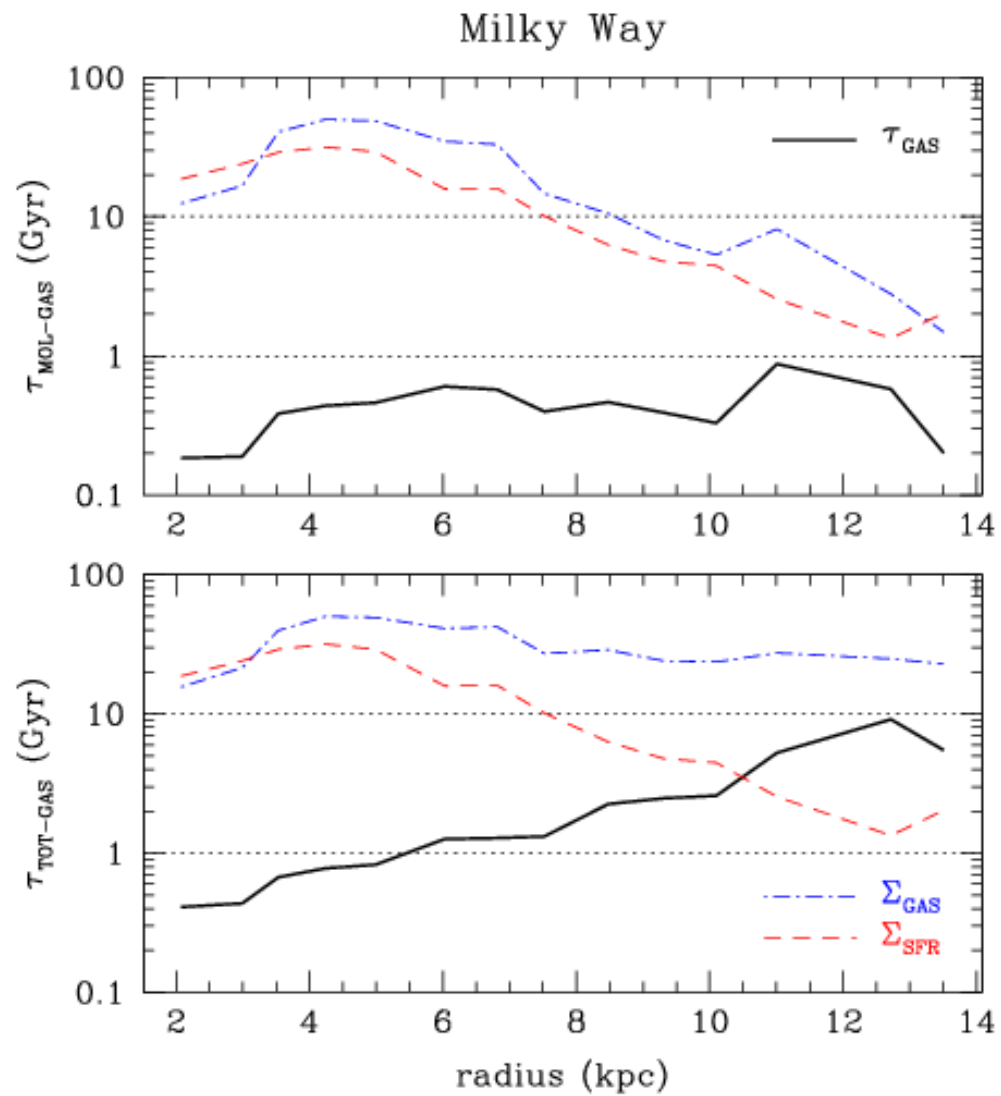
Wong & Blitz 2002

M33 HI and Stellar Surface Densities



Gas in the center is not always primarily molecular

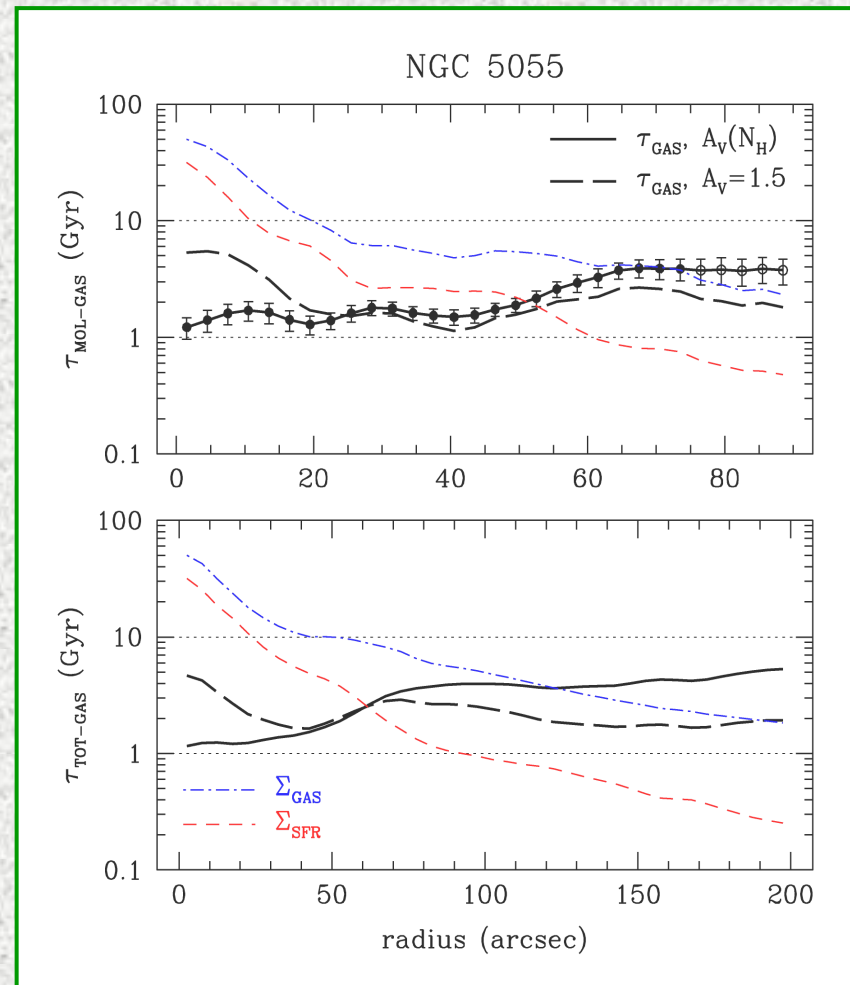
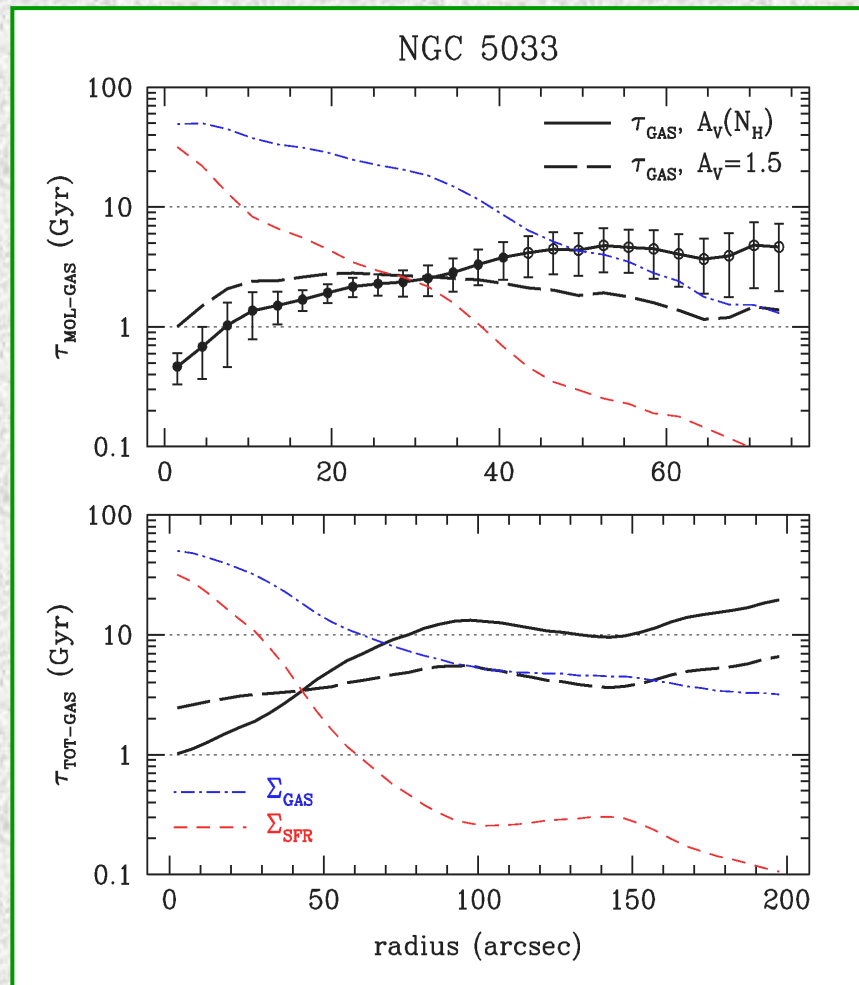
Gas Depletion Time



Wong 2001

Molecular Gas Depletion Time

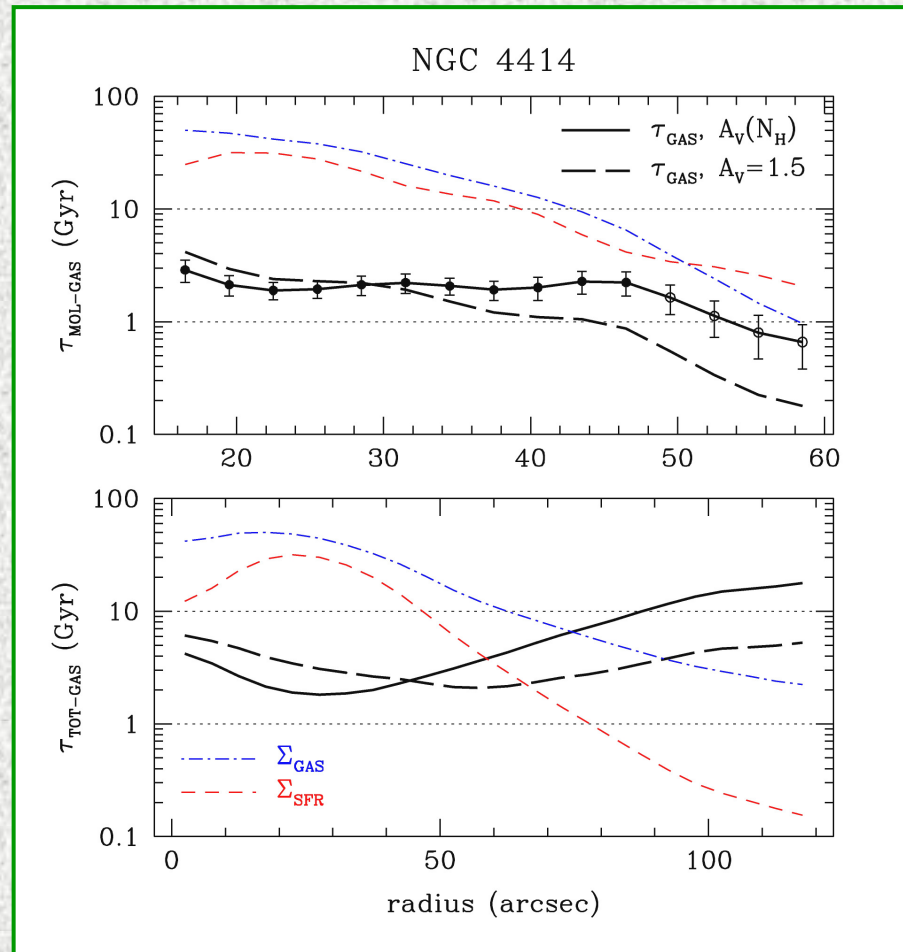
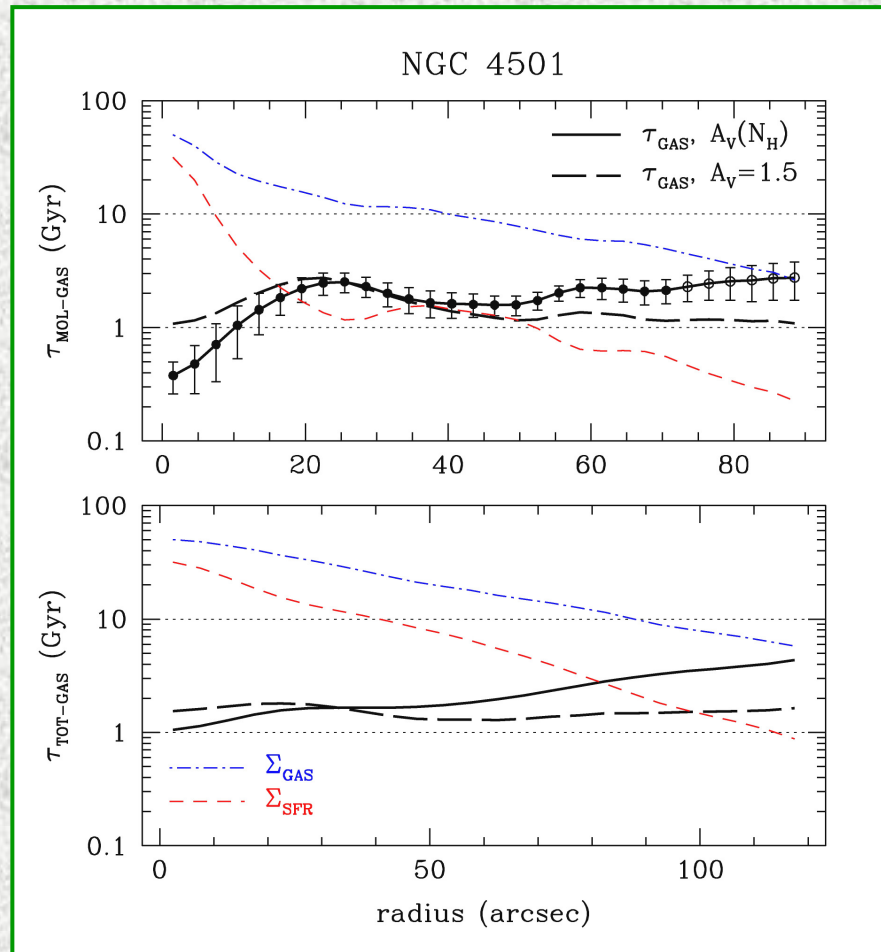
molecule – rich galaxies



Wong & Blitz 2002

Molecular Gas Depletion Time

molecule – rich galaxies



Wong & Blitz 2002

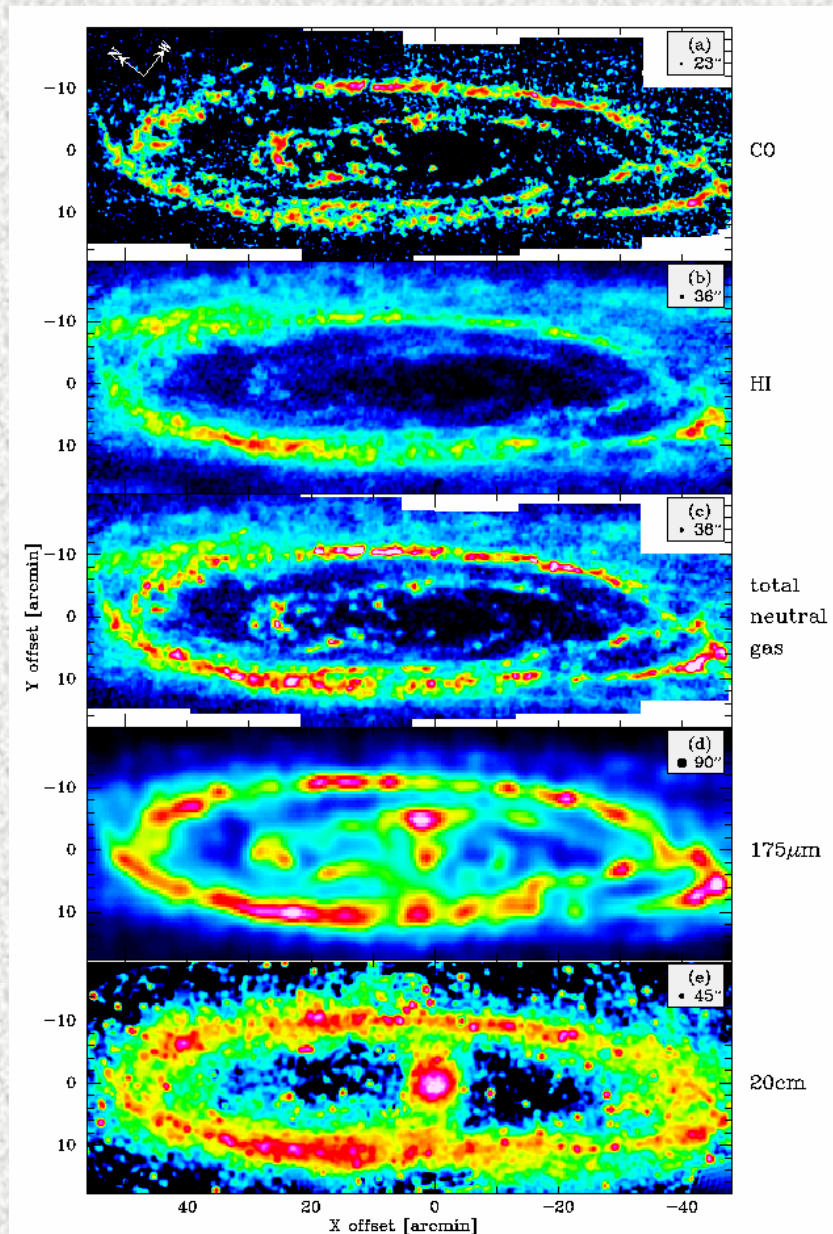
The Gas Depletion Problem

- Do we live in a special era?
- Does the Madau plot imply that we are running out of gas?
 - Problem is not running out of gas; gas is in the wrong phase and wrong place.
 - Star formation rate in disk of MW ~constant for last 5×10^9 y.
 - Problem is most severe in galactic centers (scale 5 kpc), but is also a problem in many galactic disks.

Two Standard Solutions

- Infall – Galaxies are still accreting gas from the IGM.
 - This gas will preferentially fall to the outside of galaxies, not to the center where we need it.
 - Primordial infall has not been observed. Evidence weighs against HVCs. No zero metallicity gas has been observed.
- Inflow – Viscosity, angular momentum transfer (spiral arms) brings gas to center.

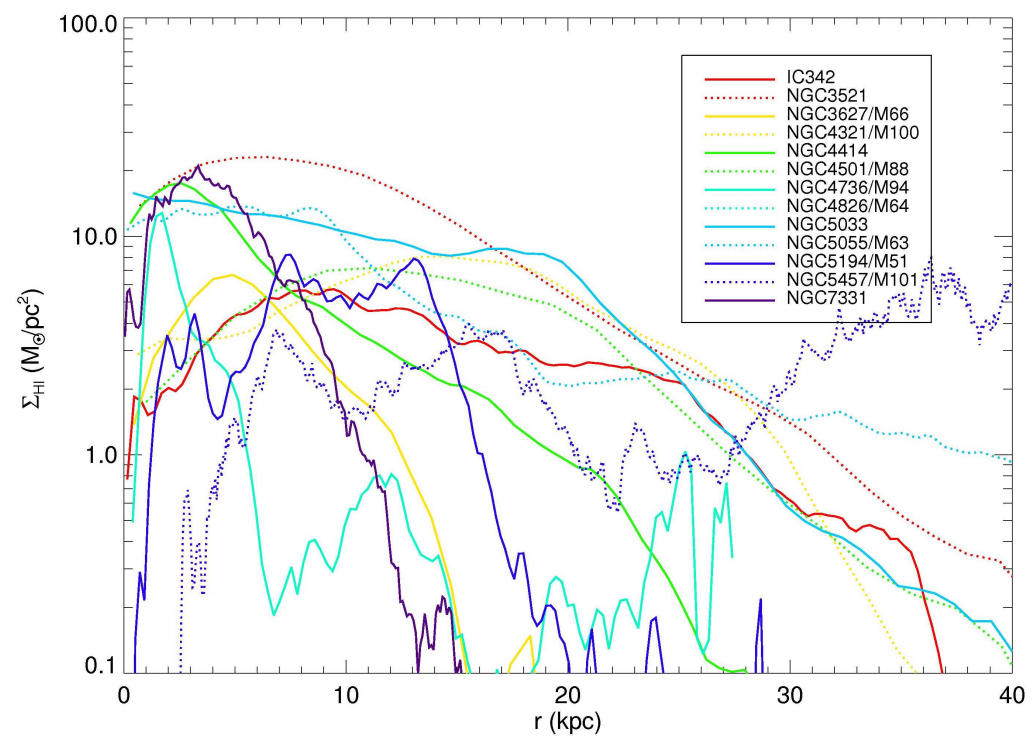
M31



If the solution to the gas depletion problem is infall, why isn't it infalling on the most massive galaxy in the local group?

Two Standard Solutions

- Infall – Galaxies are still accreting gas from the IGM.
 - This gas will preferentially fall in outside of galaxies, not in center where we need it.
 - Primordial infall has not been observed. Evidence weighs against HVCs. No zero metallicity gas has been observed.
- Inflow – Viscosity, angular momentum transfer (spiral arms) brings gas to center.
 - Has not been observed although velocities are 5-7 km s^{-1} , **except in bars**. The reservoir of HI exists mostly beyond where stellar spiral arms are found.



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