The GALEX/Arecibo/SDSS Survey: GASS

http://www.mpa-garching.mpg.de/GASS/index.php
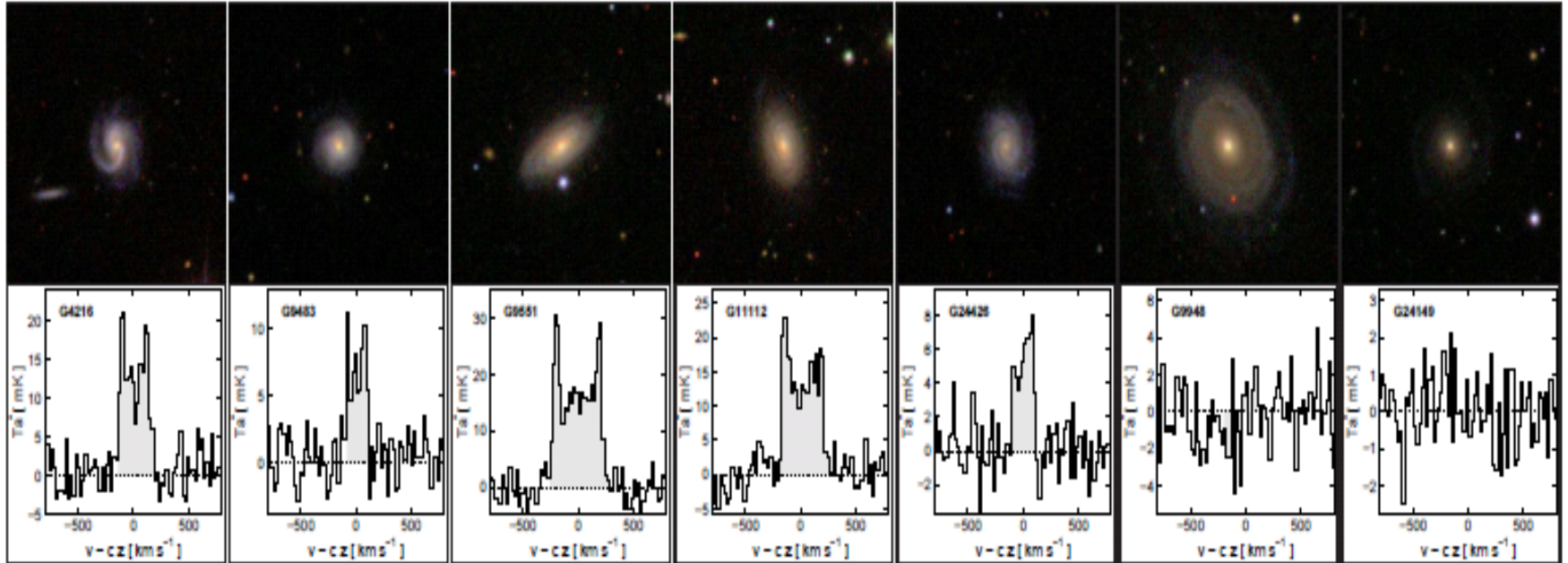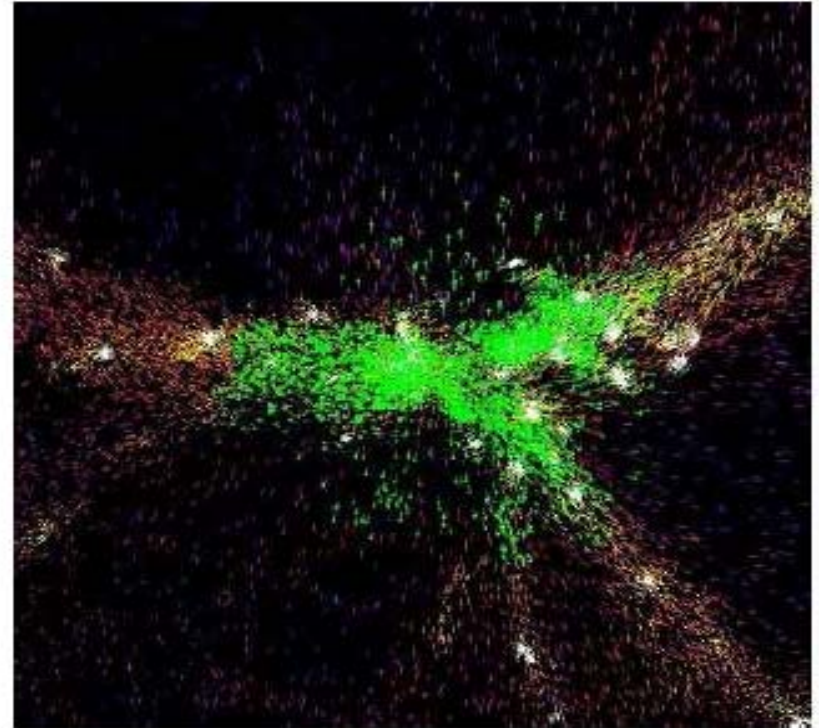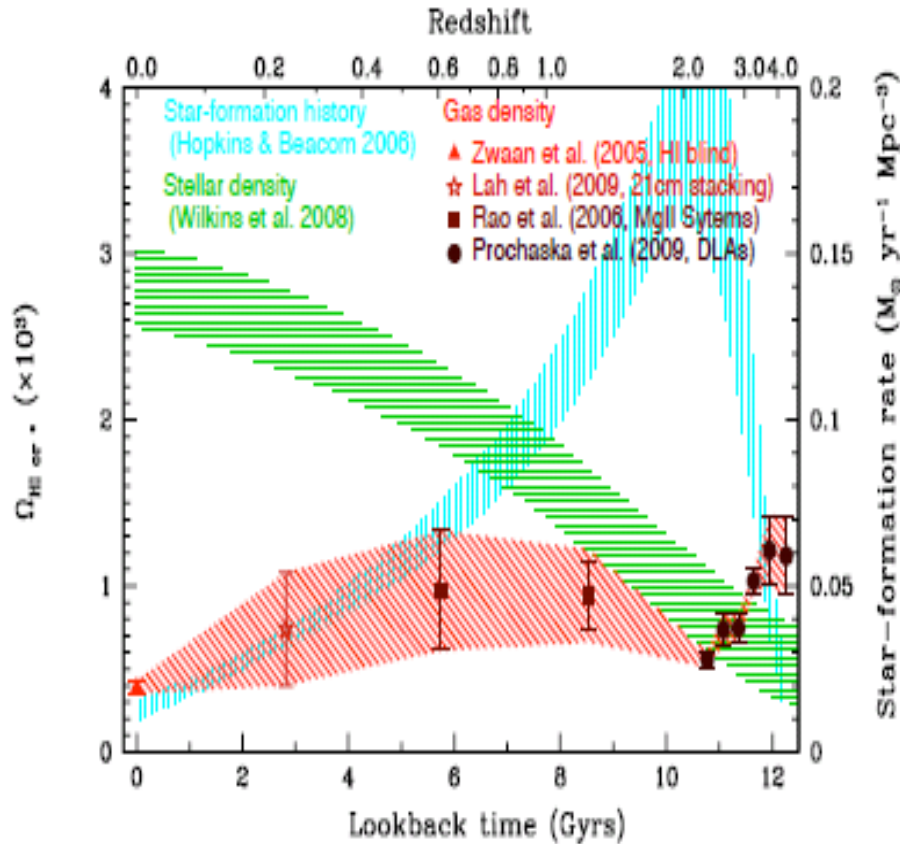
Three big questions about gas

- How does HI arrive in galaxies?
- How is molecular hydrogen replenished?
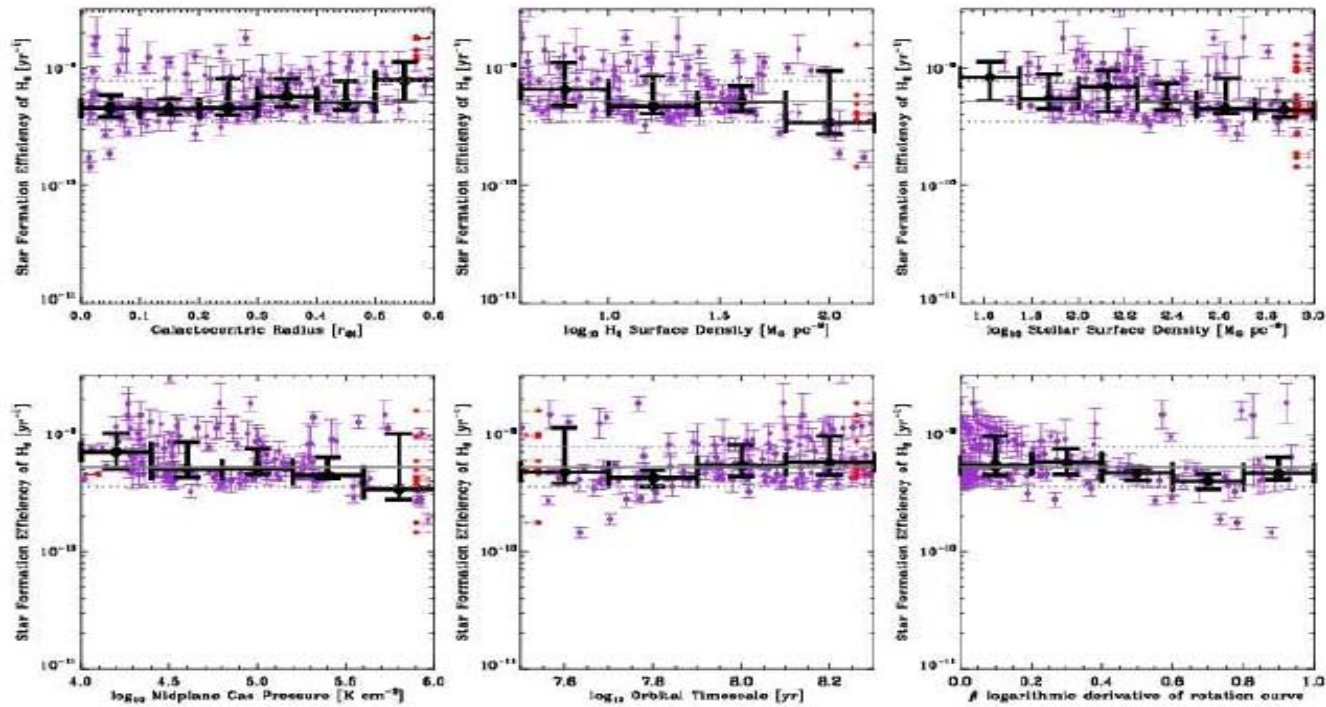- Why do galaxies run out of cold gas?

Understanding how gas gets into, through, and out of galaxies is the biggest obstacle to understanding galaxy evolution

How does HI arrive?

- The amount of HI at high-z is far smaller than the eventual amount of stars at z ~ 0
- Thus, HI must be continuously replenished

How is molecular hydrogen replenished?

- The timescale for conversion of molecular hydrogen into stars in galaxies is generically ~2 Gyr (Leroy et al.)
- Copernican principle implies this must be replenished

Why do galaxies run out of gas?
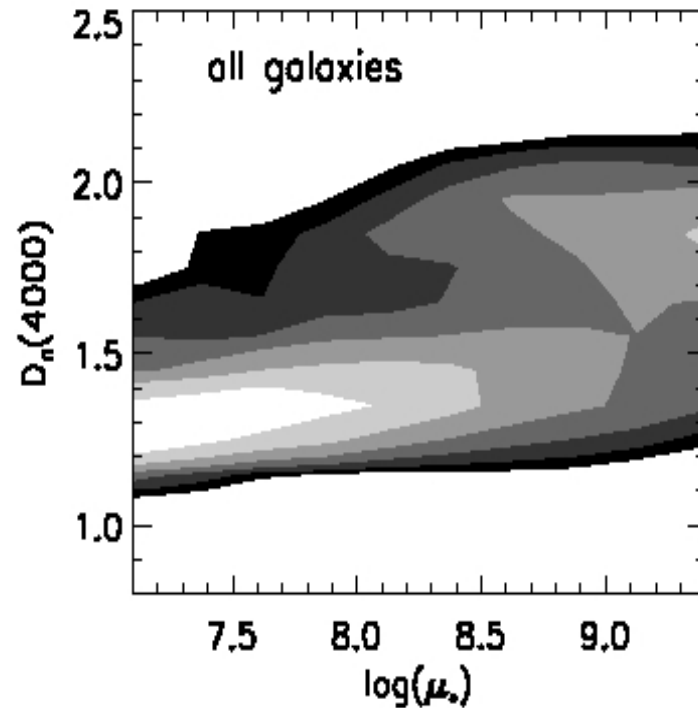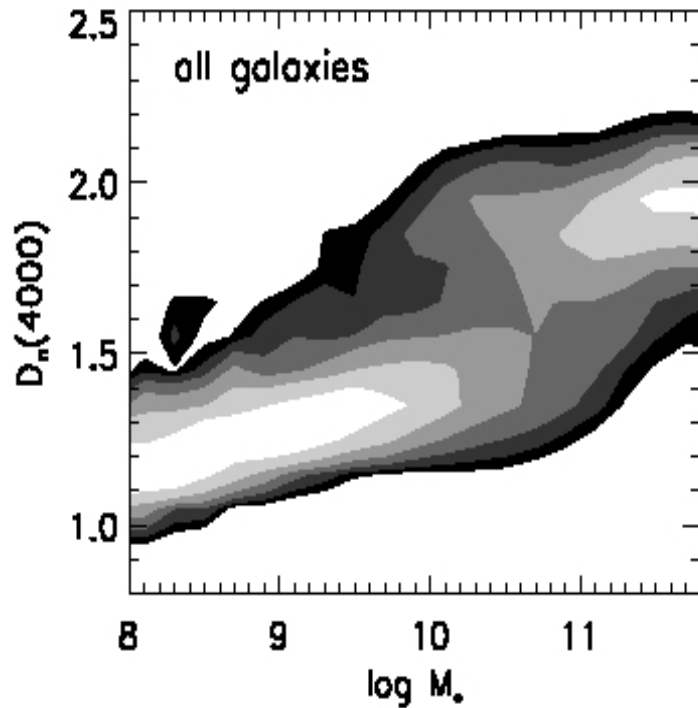
- Exhaustion of cold gas terminates star formation
- Moves galaxies from blue to red sequence

The GASS Team Leaders

- David Schiminovich
- Barbara Catinella
- Guinevere Kauffmann
- Carsten Kramer – IRAM/CO
- Sean Moran – 2-D Optical spectroscopy

GASS Sample

- Sample of ~1000 galaxies selected uniformly from SDSS+GALEX

- Stellar mass range: log M = 10.0 to 11.5 (centered on the "transition mass")

- Redshift range: z = 0.025 to 0.05

- In Arecibo declination range

GASS Data

- GALEX – NUV & FUV imaging (~5" PSF)
- SDSS – u,g,r,i,z imaging (~1.5" PSF)
- SDSS – optical spectra of center (3" fiber)
- Arecibo – HI data w/ ~3' beam
- APO/MMT -Long slit optical spectra of disk
- VLA – HI maps of selected cases
- IRAM – Pilot program for CO 1-0
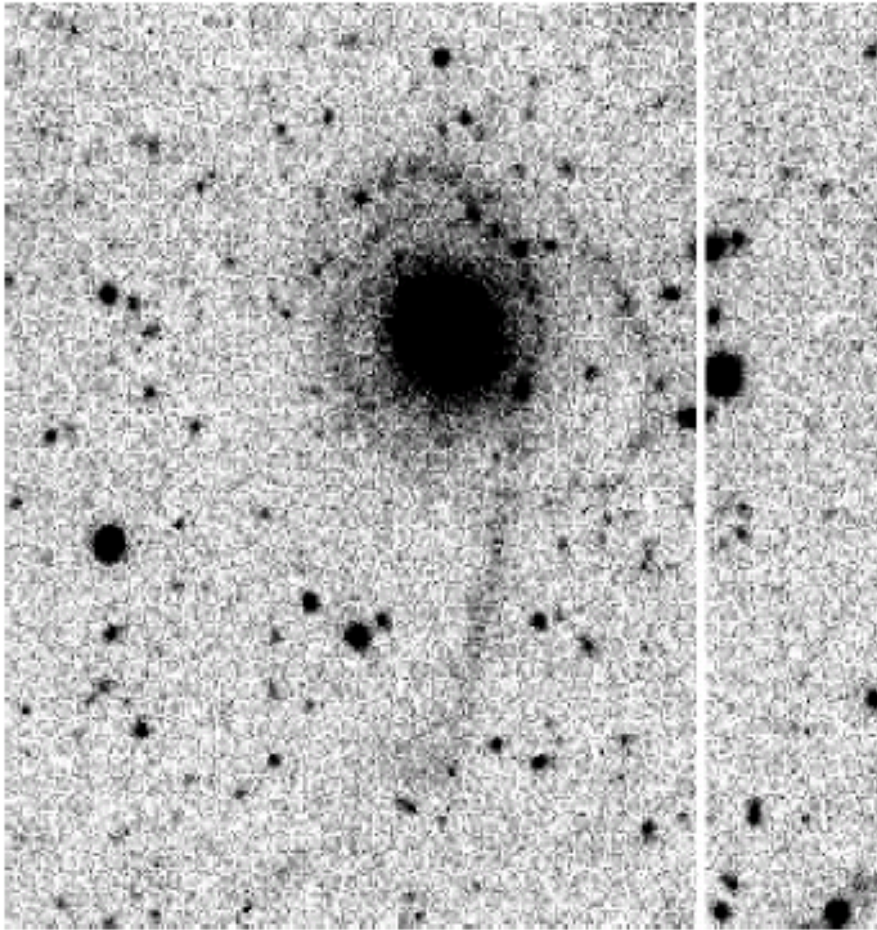 Proposal for sample of 300 is pending

Preliminary HI Results
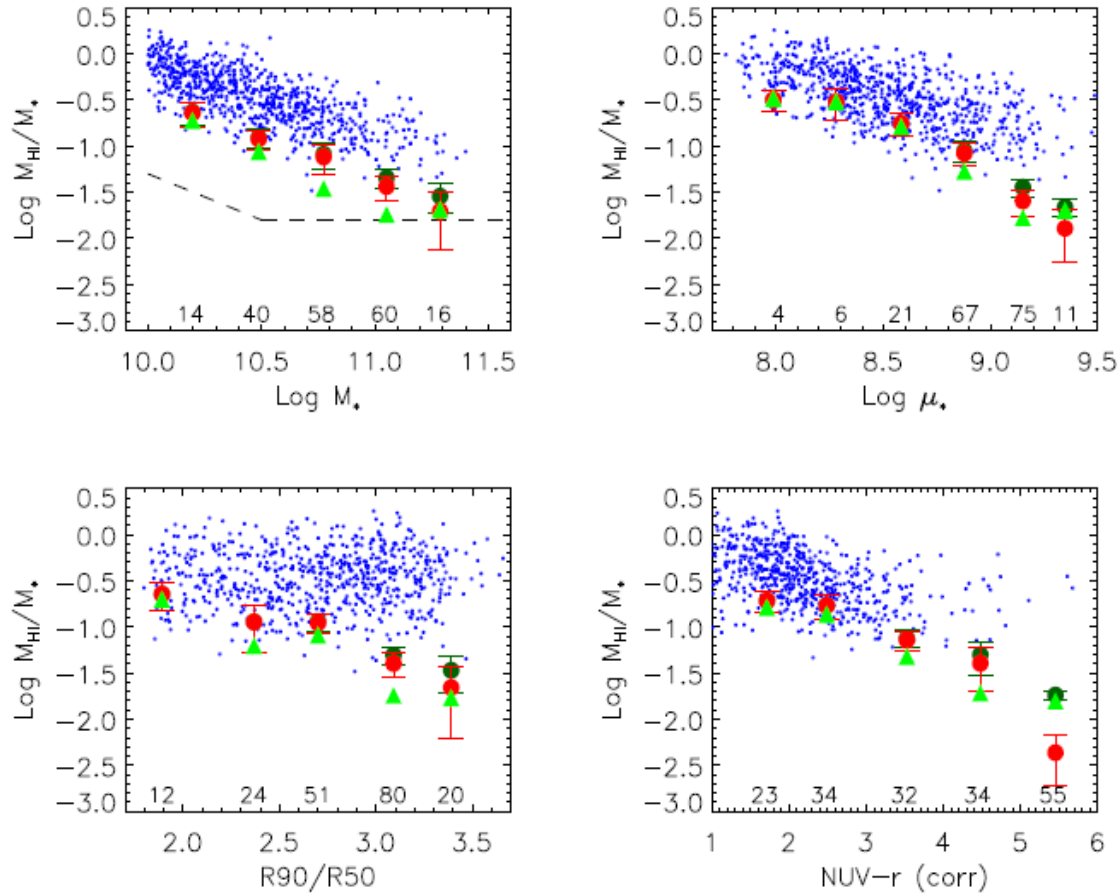
- HI mass fraction vs. global galaxy properties
- Steepest dependence on surface density and UV/opt color

The HI "Fundamental Plane"
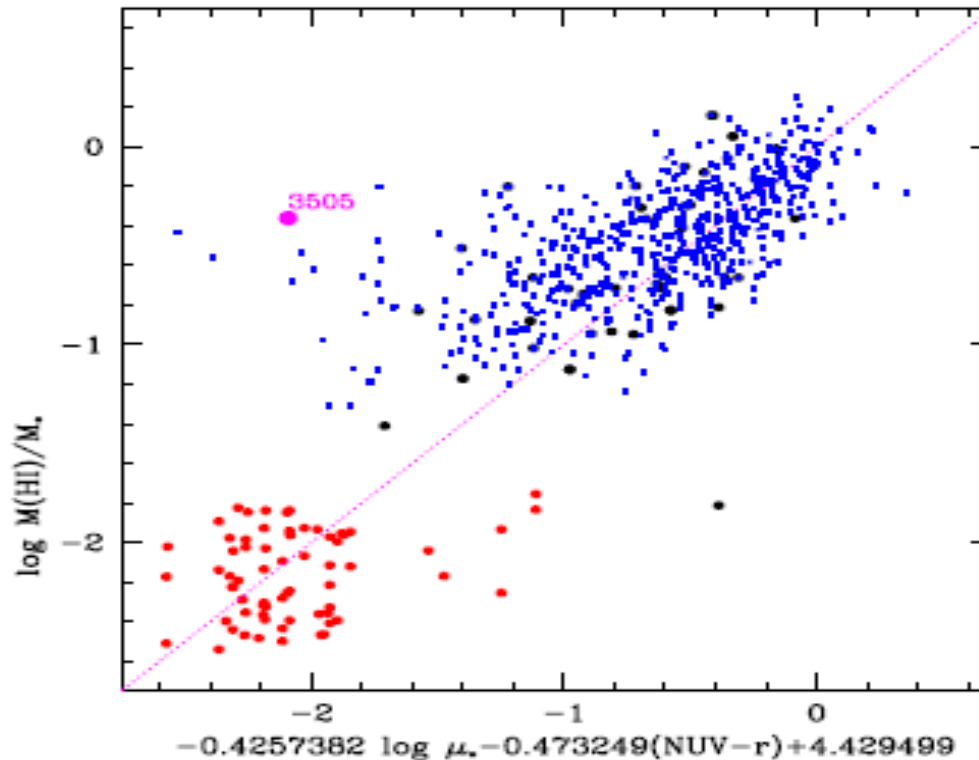
- Best fit "plane" using surface density and NUV-r color
- Small scatter for blue sequence
- Huge range in "green valley" (galaxies in transition)
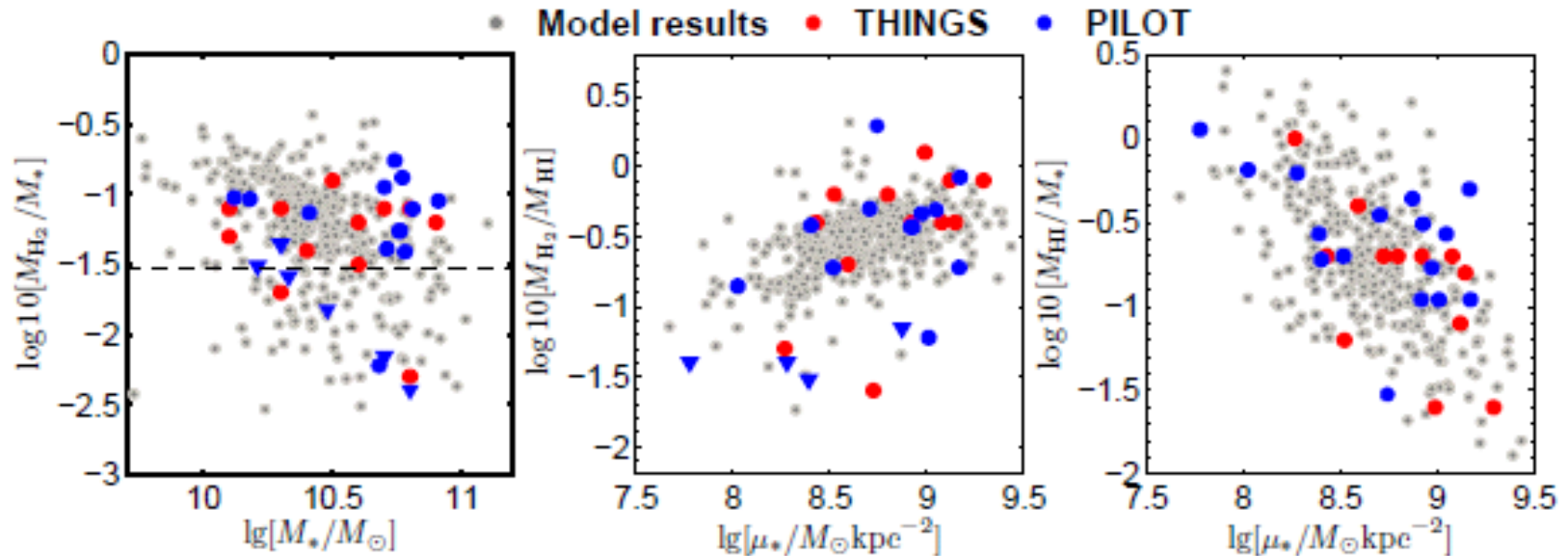
A Case Study of Late Accretion?

- Red galaxy that looks like normal elliptical in SDSS

- HI mass fraction nearly 50%

- Faint FUV envelope in GALEX

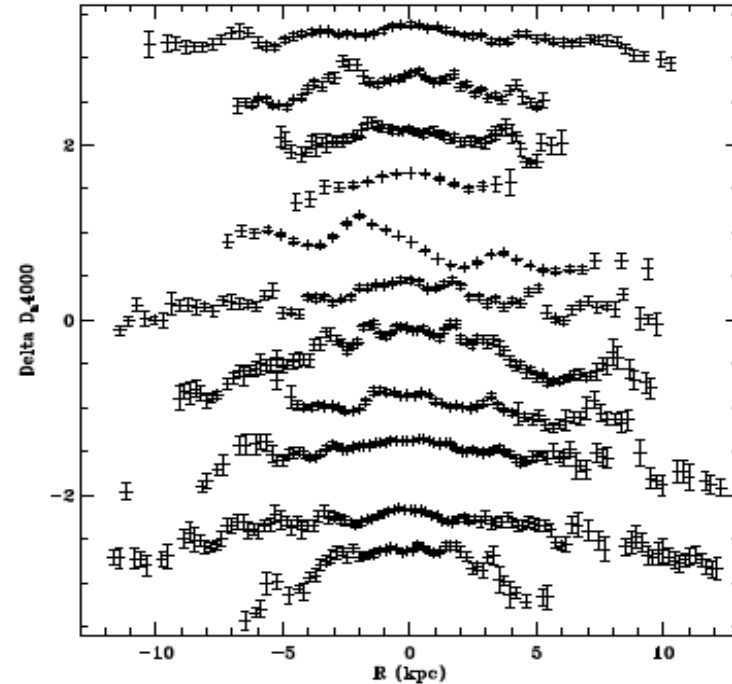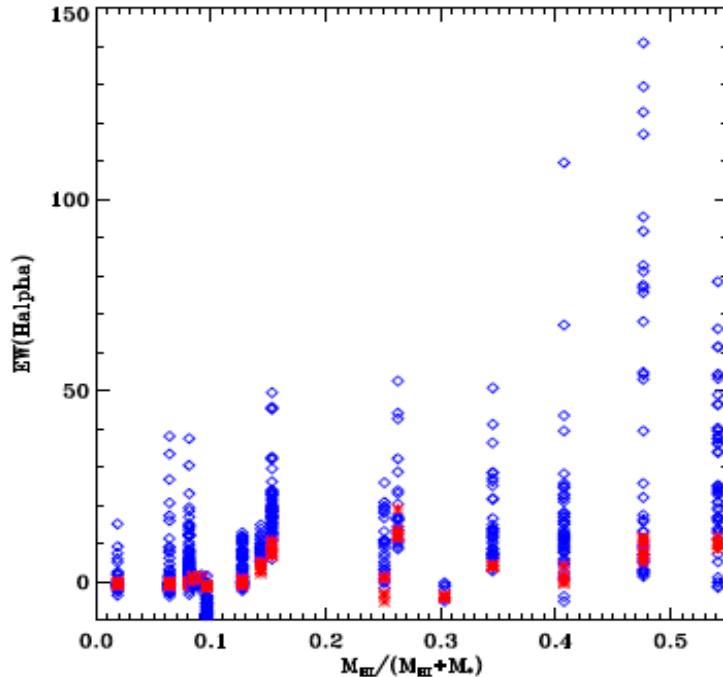- Deep KPNO image suggests recent accretion event

Quenching in progress?
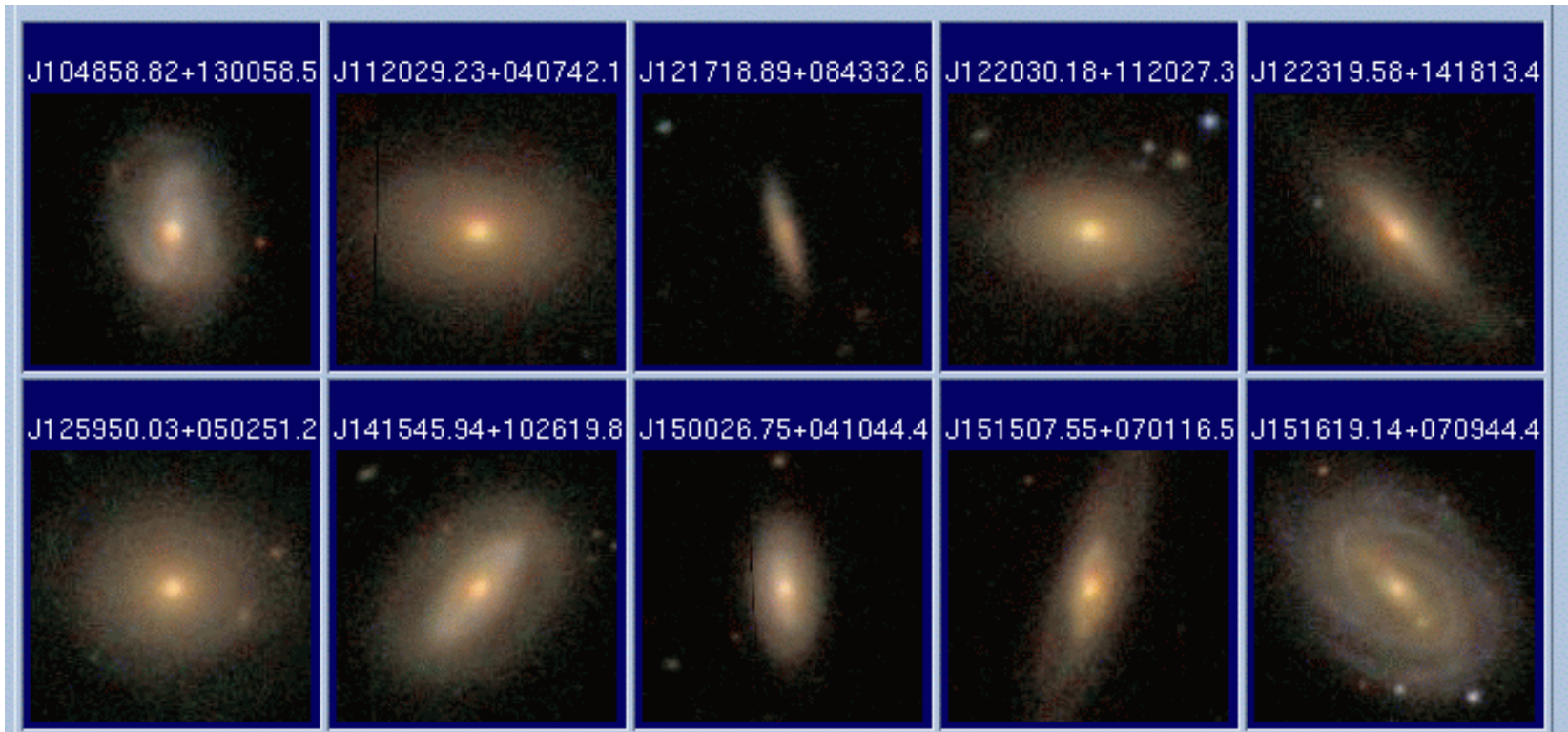
- Significant recent star-formation (UV)
- No detectable HI
- Quenching of star formation in progress?

Molecular Gas

- Small pilot program with IRAM (plus THINGS)
- Preliminary data show reasonable match to models of galaxy evolution w/ gas
- Large IRAM proposal is pending

Long-Slit Optical Spectra

- SDSS fibers cover only inner ~kpc (bulge)
- Long-slit spectra cover disk for information about global SFR, stellar population, metallicity, etc.
- See poster by Sean Moran

Conclusions

- Understanding the cycling of gas into, through, and out of galaxies is the biggest impediment to present understanding

- Investigation of atomic, molecular, and ionized gas in a large, complete, and representative galaxy sample is needed

- GASS is our attempt at this task

- Preliminary results are encouraging

- Molecular counterpart (GASSI) essential